AUTOMOTIVE INDUSTRIES

LAND — AIR — WATER

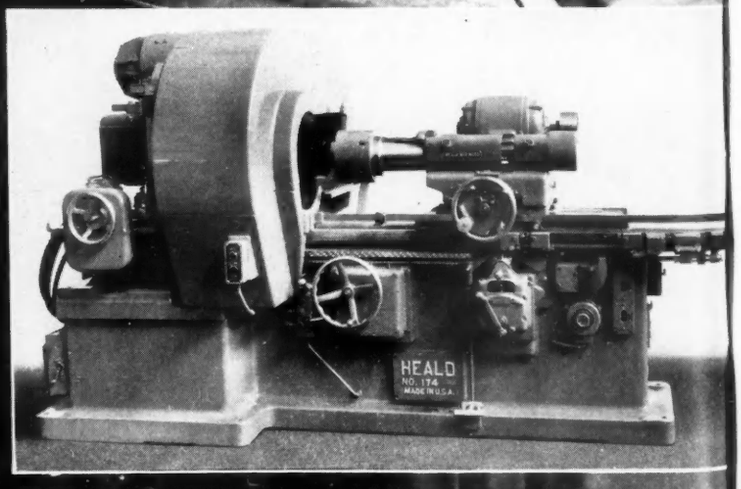
MARCH 15, 1941

RODS And Other LARGE SWING WORK

The close-up shows a No. 174 grinding large diesel rods. Swings 42" but work center only 48¼" from floor.

Large swing work of all kinds can be handled to excellent advantage on Heald Gap Type Internal Grinding Machines. Designed with gap type base which provides not only unusual swing capacity but also low work center, these machines combine ability to grind large awkward work with marked ease of operation.

Built in two sizes, the Heald No. 172 Gap Machine will swing work 36" O. D. with gap adjustment from 6" to 14"; the No. 174 Gap Machine swings work 42" O. D. and has a gap adjustment of 11½" to 20". Bulletins on either or both of these machines will be sent gladly on request.



THE HEALD MACHINE CO. WORCESTER, MASS. U. S. A.

AUTOMOTIVE INDUSTRIES
The Automobile

Reg. U. S. Pat. Off.
Published Semi-Monthly

Volume 84 Number 6

CONTENTS

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Member of the Audit Bureau of Circulations
Member Associated Business Papers, Inc.

Automotive Industries—The Automobile is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Owned and Published by
CHILTON COMPANY
(Incorporated)

Executive Offices
Chestnut and 56th Streets, Philadelphia, Pa., U. S. A.

AUTOMOTIVE INDUSTRIES. Vol. 84, No. 6. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. Entered as Second-Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In Case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin American countries, $1.00 per year. Canadian and Foreign, $2.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 1, 1941), 50 cents.

CRYSTALITE

The Crystal-Clear Plastic for "Horn Buttons"

CRYSTALITE AUTO CHART

	BUICK	CADILLAC	CHEVROLET	CHRYSLER	DE SOTO	DODGE	FORD	HUDSON	LINCOLN-ZEPHYR	NASH	OLDSMOBILE	PACKARD	PONTIAC	STUDEBAKER
HORN BUTTONS	●	●				●				●		●		
RADIATOR ORNAMENTS			●		●	●					●		●	
CLOCK DIALS, RINGS AND PANELS	●				●			●	●		●	●		
SPEEDOMETER PANELS					●						●	●		
SPEEDOMETER RINGS, POINTERS AND DIALS								●	●			●		
RADIO KNOBS AND DIALS												●		
RADIO LENSES		●					●				●		●	●
GEAR SHIFT LEVER KNOBS				●										
CENTER DASH AND GLOVE COMPARTMENT DOOR STRIP						●		●						
REAR LIGHT NAMEPLATE										●				

Molders: Bay Manufacturing Division, Electric Auto-Lite; Cardinal Corporation; Chicago Die Mold Manufacturing; Chicago Molded Products; Consolidated Molded Products; Erie Resistor; Firestone Rubber and Latex Products; Gits Molding; Inland Manufacturing; Mack Molding; Michigan Molded Plastics; Norton Laboratories; Reynolds Spring; Sinko Tool and Manufacturing; Thermo-Plastics Division, Standard Products; Watertown Manufacturing.

CRYSTALITE's clarity gives rich depth to the Buick, Cadillac and Packard emblems molded into 1941 steering wheel ornaments. Filled with pigment, the design stands out in vivid relief against a painted or metal background.

On the new Nash, a sturdy CRYSTALITE horn ring is used to sound the horn as well as to add distinction to the whole assembly; and on the Dodge, a CRYSTALITE steering wheel name plate illustrates another ingenious gem-like handling of acrylic moldings.

To see and to learn more about other possible uses of these crystal-clear moldings, phone our Detroit representative, W. E. Biggers, 619 Fisher Building, Madison 1500.

THE CRYSTAL-CLEAR ACRYLICS

CRYSTALITE
MOLDING POWDERS
PLEXIGLAS SHEETS AND RODS

RÖHM & HAAS COMPANY
WASHINGTON SQUARE, PHILADELPHIA, PA.

Manufacturers of Leather and Textile Specialties and Finishes . . Enzymes . . Crystal-Clear Acrylic Plastics . . Synthetic Insecticides . . Fungicides . . and other Industrial Chemicals

IN THIS ISSUE . . .

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Volume 84 March 15, 1941 Number 6

No Priority Ruling On Airplane Parts

Manufacturers of parts and accessories for aircraft are at liberty to fill contracts to scheduled commercial air lines so long as the execution of military contracts is not impeded. The commercial orders need not be accompanied by preference ratings.

Notice to this effect has been announced by the OPM in a joint statement by E. R. Stettinius, Jr., Director of Priorities, and Arthur D. Whiteside, chairman of the Commercial Aircraft Group.

The statement was issued because during recent weeks, Mr. Stettinius said, inquiries have shown that producers of aircraft parts and accessories were not fully informed about their rights in filling orders from the civilian air lines. He said that it is the intention of the Priorities Division to see to it that there is a free flow of necessary parts and accessories to the air lines for maintenance and repair purposes.

Refinery Capacity of 100 Octane Fuel Higher

United States petroleum refineries now have a capacity to produce 100-octane aviation motor fuel more than four times the total 1939 demand in this country for all grades of aviation fuel, which amounted to 130,000,000 gallons. Six years ago 100-octane fuel was a laboratory curiosity costing $30 a gallon.

According to Dr. Robert E. Wilson, director of the OPM petroleum unit, world production of gasoline is distributed as follows: United States, 62½ per cent; other Western Hemisphere countries, 15.1; Russia, 10.3; Near East, 5.6; Dutch East Indies, 3.2; Rumania, 2; Germany, Poland, Japan, Italy, Bulgaria and Hungary combined, 0.7 per cent.

Despite this, Dr. Wilson says, Germany now has enough gasoline to serve both her army and air forces, though the civilian use has been virtually wiped out, has on hand a present a production of from 60,000 to 70,000 barrels per day.

AVIATION INDUSTRIES

AUTOMOTIVE INDUSTRIES

Published on the 1st and 15th of the month

Vol. 84, No. 6
March 15, 1941

Training for National Defense

How the Work of Many Agencies is Being Coordinated in Mobilizing Our Huge Industrial Army

By E. L. Warner, Jr.

Mobilization of this country's industrial manpower is one of the prime requisites of the national defense program. Men must be trained to provide the materials which constitute the sinews of war. This industrial army may lack the dramatic appeal of the U. S. Army, Navy and Air Corps but its training is just as important if the fighting forces are to be given the vital armaments to protect our national security. Every man on active military duty requires 18 productive civilians on the home front to keep him supplied with materiel and food.

Early in the rearmament effort, the Council of National Defense realized the big part that labor would play. Although the nation had a vast army of unemployed variously estimated at 7,000,000 to 11,000,000 persons before the national defense emergency occurred, most of these men had to be trained in special skills before they could take their places in the production picture. In some skilled crafts such as tool and die designing, aircraft engineering, precision machine operation and molders, the supply of experienced men soon was exhausted. To meet these shortages, the Training Within Industry program was drafted to coordinate the training of defense workers by the various government and state agencies. Directing this program is Channing Dooley, on leave as Personnel Director of Socony-Vacuum Oil Co., who is serving as executive assistant to Sidney Hillman, of the Office of Production Management.

The underlying purpose of the Training Within Industry program, as stated in its initial bulletin last fall, is "To assist defense industries to meet their manpower needs by training within industry each worker to make the fullest use of his best skill up to the maximum of his individual ability, thereby enabling production to keep pace with defense demands."

Welding is playing an important part in production for defense. The Detroit Board of Education is training many men for this kind of work

At manufacturing centers throughout the country some WPA workers are being trained and others are given refresher courses for skilled jobs in the Defense program

Training Within Industry eventually will have 22 district representatives who will direct the program in their respective districts, which may consist of a limited area like New York City or a group of states, such as Missouri, Arkansas, Oklahoma and Kansas. As a typical example, the district comprising Michigan and northwestern Ohio has Milton M. Olander, industrial relations director of the Owens-Illinois Glass Co., Toledo, as district representative. His assistant is O. Frank Carpenter, who is on leave as principal of Wilbur Wright High School, Detroit trade school, to devote his full time to the defense program.

A four-man advisory board, two from management and two from labor, is assisting Olander. They are Frank Rising, general manager of Automotive Parts & Equipment Manufacturers, Inc.; Willis Hall, manager of the industrial department of the Detroit Board of Commerce; John Reid, secretary of the Michigan State Federation of Labor (AFL), and Walter Reuther, regional director of the UAW-CIO. There also is a 15-man panel of personnel and training consultants which includes Maj. Albert Sobey, director of General Motors Institute, Flint; Frederick E. Searle, superintendent of Henry Ford Trade School; C. E. Weiss, industrial relations director of Packard Motor Car Co., and H. J. Roesch, industrial relations manager of Briggs Mfg. Co. The purpose of this panel is to help solve the training problems of companies with defense contracts especially the small companies which lack experience in such work.

The Training Within Industry staff renders advisory assistance in analyzing training needs, setting up plant programs to meet those needs and making available the experience of other employers who have met problems in similar fields. It also acquaints plant management with other government agencies that can be of service in job training and in locating labor for a specific type of work.

Despite the large number of unemployed, there is no pool of skilled labor available in this country. This is not surprising when for a period of years men were paid for not working. This compels industry to undertake piecemeal training of workers on the job. The aircraft industry, for example, is more than doubling its employment rolls in less than a year, expanding from 203,000 workers last October to 455,000 next August. Not the making of craftsmen but the getting out of production is the primary objective in the present defense emergency.

The schools of the country are rendering fine service in cooperating with industry in vocational training. However, they are handicapped by lack of equipment, which is more urgently required by defense industries, and by lack of capacity. This may be due to short sighted policy in the past of neglecting vocational education, thus putting the problem in many cases squarely on the shoulders of industry.

Many industrialists are too complacent in their outlook towards a possible labor shortage, in the view of several personnel experts. They forget that their old sources

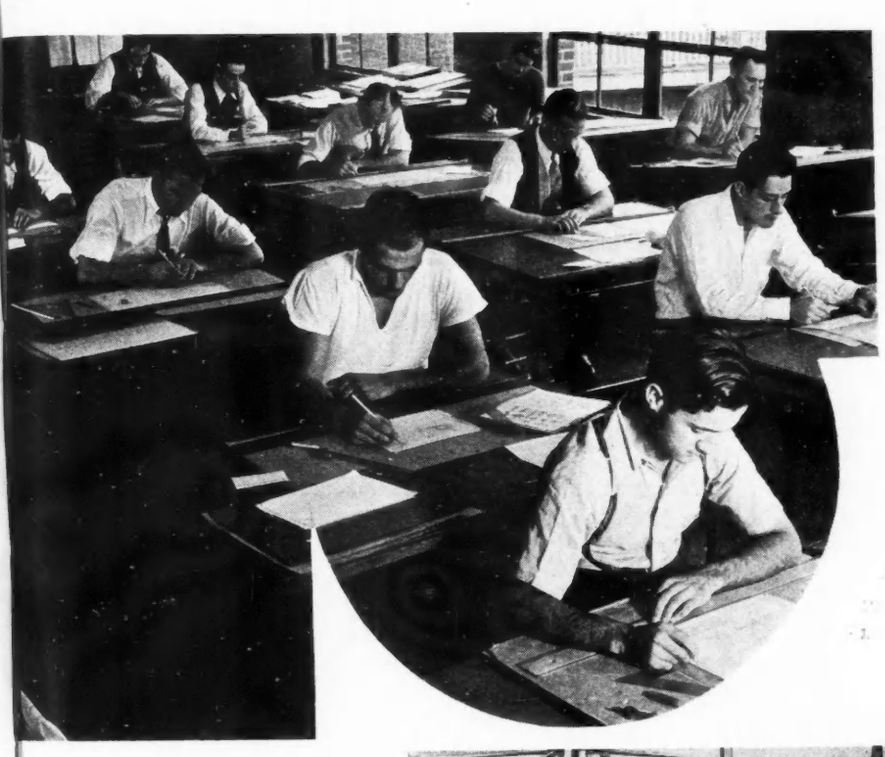
An aviation ground school is part of the Training Within Industry program at Utica, N. Y.

W.P.A. photo

of supply may be exhausted by the defense emergency. Thus if some of their men are drafted or others shift to defense jobs for pecuniary or patriotic motives, they may find themselves with an acute labor situation. Companies which have maintained apprentice systems or training schools even through profitless years are now reaping the benefits of earlier expenditures with an adequate supply of skilled labor.

Of course, many companies, such as aircraft and machine tool, were unable to anticipate the unusual expansion which they have undergone, so even apprentice programs have proven entirely inadequate in the present situation. They have had to resort to intensive job instruction in many cases. This involves having experienced workers break in new men on the job, upgrading of workers to better jobs and the training of supervisors.

Breaking in of new men on the job is facilitated if the experienced worker picks out the key points in the operation and imparts these "knacks" to the trainee. Research has proved that trainees who master these key points learn in one-third the time of other trainees. In the machine tool industry, the observation method of train machine operators has proved valuable in teaching new men over a two or threemonth period. Warner & Swasey Co., Cleveland, trained more than 900 men by this method and many of them advanced into the skilled worker class after another two to four-month period. The "vestibule school" system employed in the munitions industry during the first World War also has proved advantageous in some defense plants. Under this system new workers are given brief, intensive instruction in their particular jobs in a factory school set up separately from the regular production departments However, the school conditions should simulate those in the factory as far as possible.



Upgrading within industry is effective in providing incentive for the worker by a progression of jobs through which he can improve his pay rating by acquiring higher skills. While expanding the skilled labor force, this system also has the merit of maintaining high morale based on the chance for advancement. Unions will cooperate on upgrading if it offers advancement but not supplantation of the older skilled workers. When a shortage of tool designers was experienced at a Detroit plant, some expert toolmakers were given instruction in drawing to qualify for the work.

The Detroit Board of Education is cooperating. Here are some designers of the future in a drafting class

This view shows students at the WPA ground school in Utica, N. Y. working on a wing structure

In selection of men to be trained for supervisory positions, those chosen should possess intelligence, personality, vitality and other leadership abilities, which should outweigh purely technical skill. Under a plan utilized by some companies, competent supervisors are

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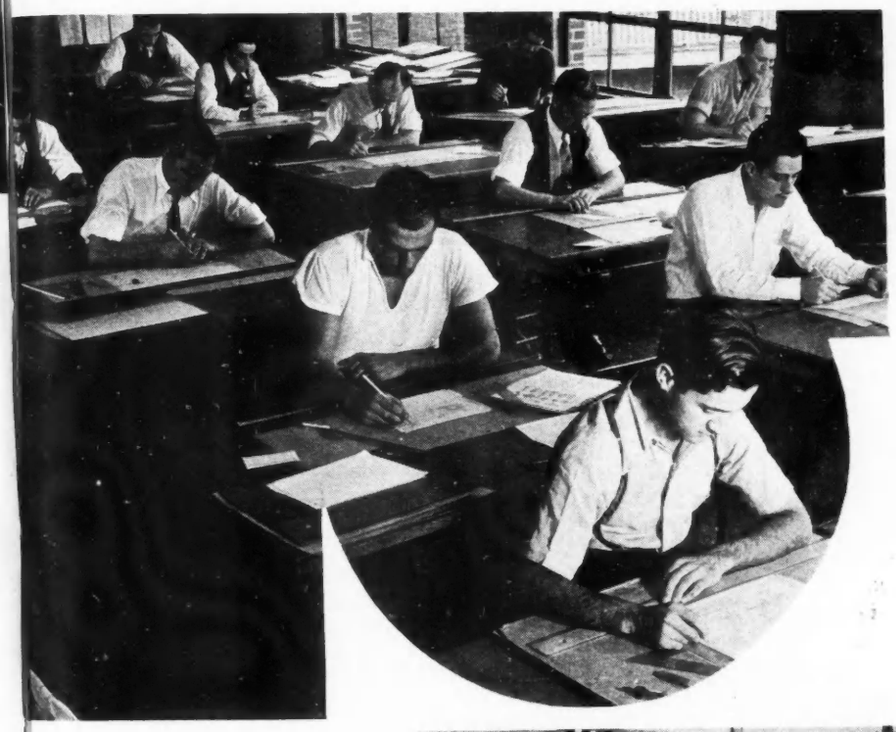

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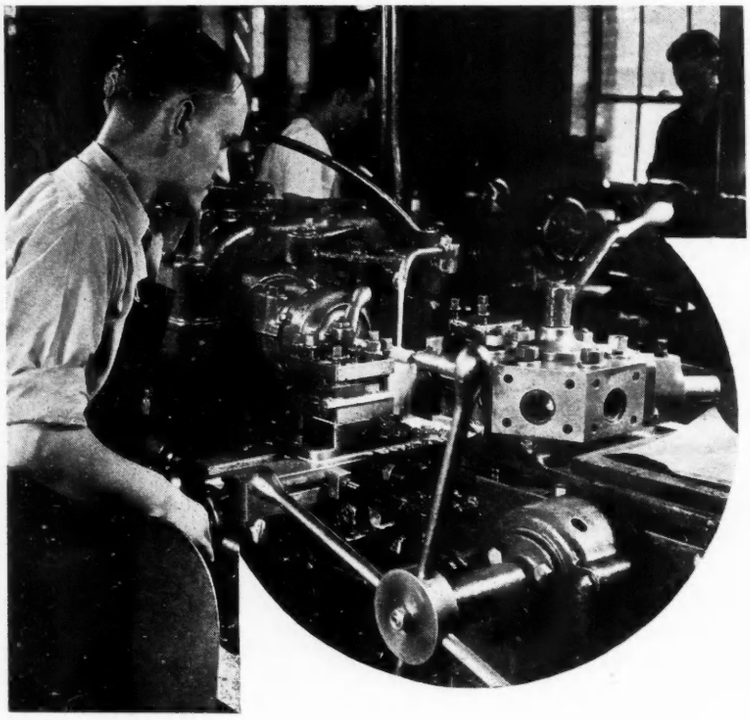


This operation of a turret lathe shows the progress the Detroit Board of Education is making in training skilled mechanics

developed in an eight to ten-week course. This entails undertaking some supervisory responsibility, an intensive instruction course of two weeks and then more difficult responsibilities under experienced guidance.

Akin to the development of supervisory talent is that of preparation of instructors for intensive job instruction. These men should be chosen for their ability to express themselves and to get along with other people in addition to possession of mechanical skill. Training of job instructors should be done in groups of not more than 10 men and often can be completed in two weeks. A proper wage differential should exist between the rate for instructors and the top rate for the work classification for which they are training men.

Training Within Industry should not conflict with already established apprenticeship programs which usually are for a four-year period and have a definite advantage in the long-term development of craftsmen. Such programs are paying dividends in the skilled workers they are providing for industries that have supported them.

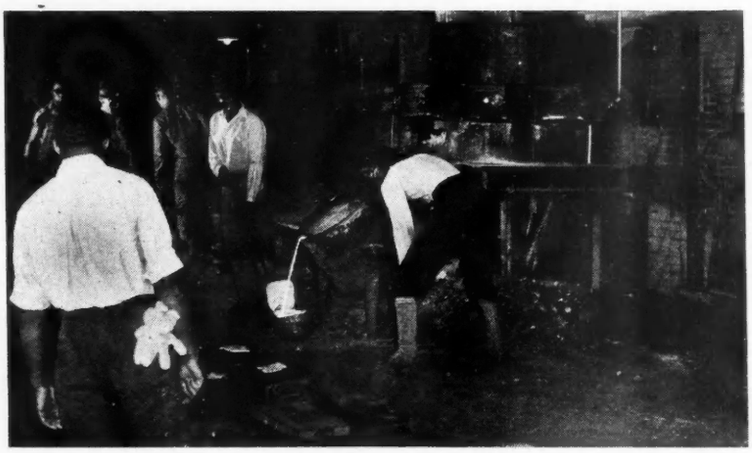
The lack of apprentices and of training programs has been particularly evident in the metal-working industry. A survey by the American Society of Tool Engineers revealed that only 30 per cent of all metal-working plants had any type of apprenticeship training program, while only an additional 11 per cent had any system of training men for their particular requirements.

This survey showed an immediate need for 32,600 tool engineers, 128,000 tool and diemakers and more than 400,000 skilled mechanics. To help fill the need for machine operators, the A. S. T. E. has drawn up a model four-week training program. Under this program, the first week would be devoted to 34 hours of classroom work, including shop arithmetic, applied science, blueprint reading and use of measuring instruments. The next three weeks would be devoted to concentrated shop work on a single machine tool. Then the trainee enters the plant as an observer beside a regular operator and gradually works into the job of running the machine in two to six weeks' time.

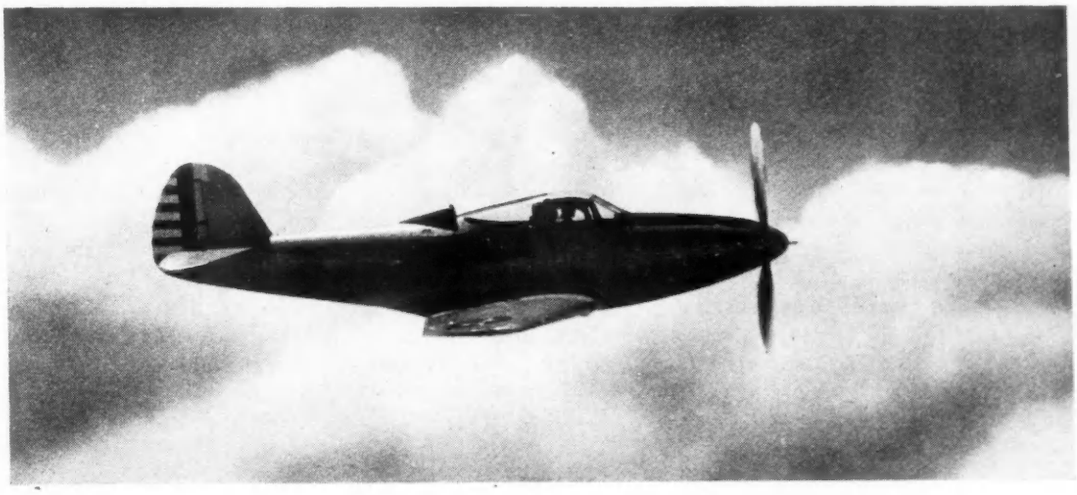
To further the training of defense workers through the school system, Congress last summer appropriated $60,500,000 to provide 750,000 workers for defense jobs by June, 1941. Working with this program have been the Office of Education, the U. S. Employment Service, the Works Progress Administration, the Civilian Conservation Corps and the National Youth Administration, as well as the agencies of local and state governments.

Michigan, with over one billion dollars in defense orders, has one of the most advanced of these school programs operating under the control of the State Board of Control for Vocational Education. There are two instructional divisions—pre-employment and refresher courses for unemployed or WPA workers and supplementary classes for employed workers seeking additional skills. Pre-employment trainees are assigned to one of 22 essential occupation courses, six hours a day, five days per week, for an eight to 12-week period. Refresher classes for "rusty" workers last six to 10 weeks. Supplementary applicants must be

(*Turn to page* 360, *please*)



Foundry technique comes in for much attention in the Detroit program



The Airacobra P-39 is powered by an Allison engine of 1090 hp. and has a cruising range of 1000 miles at 250 mph.

Today's Problems of the Aviation Engineer

By A. T. COLWELL*

HIGH altitude flying is essential in modern warfare. This war is being fought at 30,000 ft., and it would be desirable to go to 40,000 or 50,000 ft. The demand is for higher speeds at higher altitudes. Planes with the highest ceiling have a tremendous advantage. There are two practical obstacles to operating at such altitudes: First, the human; second, the mechanical.

If a glass of water is put in a chamber and the air exhausted at a barometric pressure equivalent to about 18,000 ft., bubbles will rise in the glass, and these will be numerous at 25,000 ft. The dissolved gases are escaping. Exactly the same phenomenon occurs at high altitude with a pilot, nitrogen escaping from the tissues and blood stream. It is called aeroembolism. This causes, drowsiness, fatigue and impaired senses. At 30,000 ft. the pilot would become unconscious in about 20 sec., because the oxygen supply is diminished. The oxygen partial pressure in air is only 22 per cent, and at 30,000 ft. the barometric pressure is only 4 lb. Oxygen must, therefore, be fed to the pilot to restore this partial pressure; and this restores the pilot toward normal; but 35,000 ft. is about the limit a pilot can stand, even with oxygen, because the internal body pressure and external barometric pressure are so unbalanced that the human system will not properly function. The amount of oxygen delivered into the blood stream depends directly upon the partial pressure of the oxygen contained in the lungs, rather than the percentage of oxygen, or the total pressure of the combined gases.

Partial oxygen pressure can be increased by cabin pressure, using a Roots blower or centrifugal compressor driven by the main engine or an auxiliary plant. Temperature rise through the blower may be as much as 200 deg. Fahr. A cabin differential pressure of about 2½ lb. is maintained in commercial

* Abstract of paper read before Detroit Section S.A.E. Mr. Colwell, Vice-President of Thompson Products, Inc., is President of S.A.E.

flying—and the English plug bullet holes with bottle stoppers from the dime store. Therefore, above 35,000 ft. either a pressure cabin must be used, or a new development upon which much research work is being done by our Army—the pressure suit. Either of these devices will permit higher altitudes.

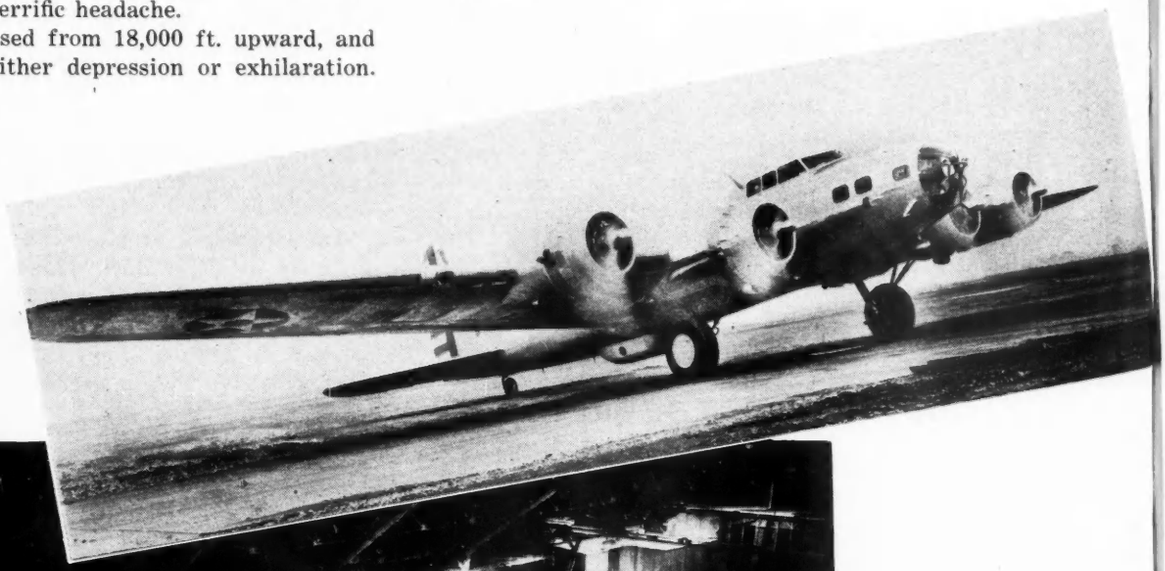
In the latest oxygen mask used by our Army, the oxygen flow is controlled, dependent upon the barometric pressure, and the exhalation bag has increased the efficiency of the oxygen supply about nine times. It works as follows: only a portion of the inhalation goes into the lungs—the remainder fills the cavity about the lungs. Exhalation is into the bag, and this oxygen is again used.

Pilots are also subject to the "bends," which is similar to the "bends" of caisson workers under changing pressure, and causes temporary paralysis, with much pain. Training is necessary for making fast ascents to high altitude. One pilot recently told me that it was necessary for him to go to 32,000 ft. that day, and that it would be 52 deg. Fahr. below zero. Going up, with the motor on, he would be warm, but on descending it would be very cold, and he would go to bed early with a terrific headache.

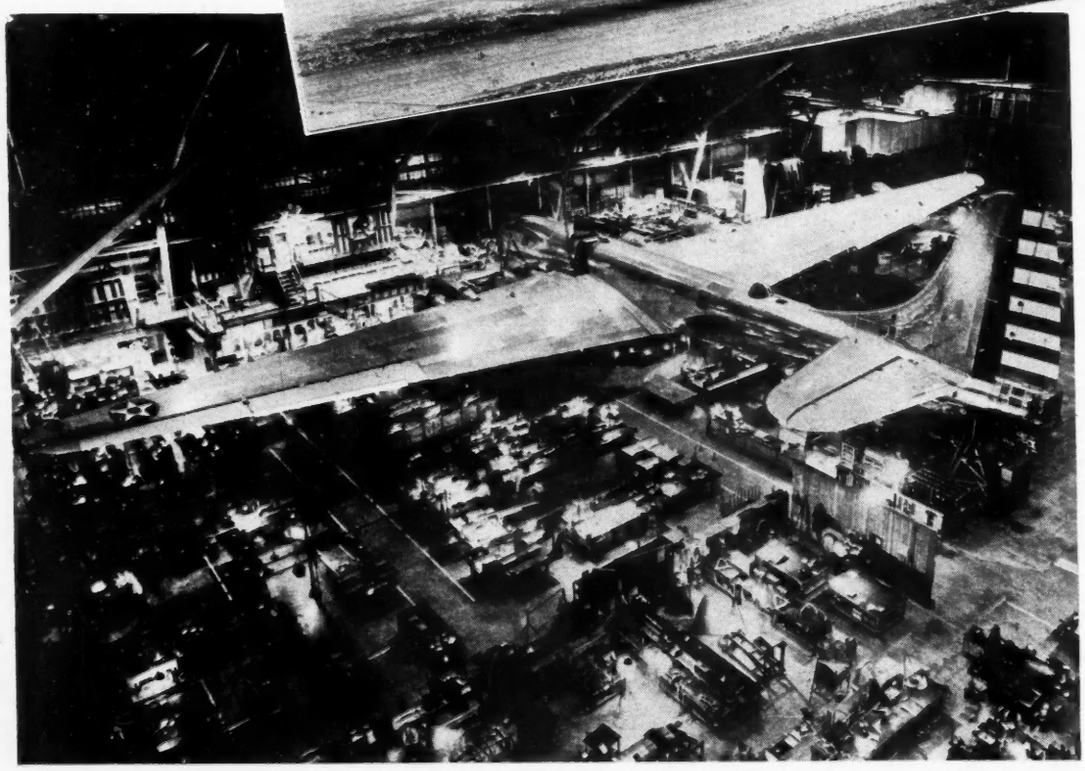
Oxygen must be used from 18,000 ft. upward, and its use may cause either depression or exhilaration. Exertion fatigues a man quickly at high altitudes—hence one reason for the power turret and automatic fuel supply. Carbohydrates, such as candy, add 1000 to 2000 ft. to the pilot's ceiling. Activity greatly increases the amount of oxygen needed, but excitement or fright does not.

The second practical problem in attaining altitude is loss of motor power, and vapor lock. Power falls with altitude and consequent loss of barometric pressure. The two-stage supercharger and the turbo supercharger are used to restore power, and even increase plane speed in the substratosphere. Both are satisfactory, giving about equal performance; but experts feel that the turbo may be more widely used, due to its flexibility.

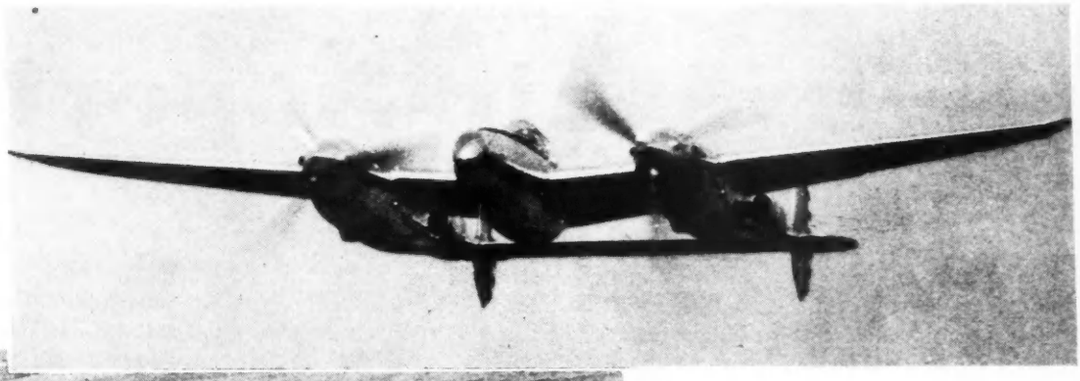
The problem of vapor lock has been met by an auxiliary booster pump at the fuel tank. This is a centrifugal electric pump to be operated when the pilot finds his fuel pressure too low. Suction on the intake side of the fuel pump, plus the lower barometric pressure, causes the fuel to boil. The booster pump restores pressure to the fuel pump, eliminating the vapor lock.



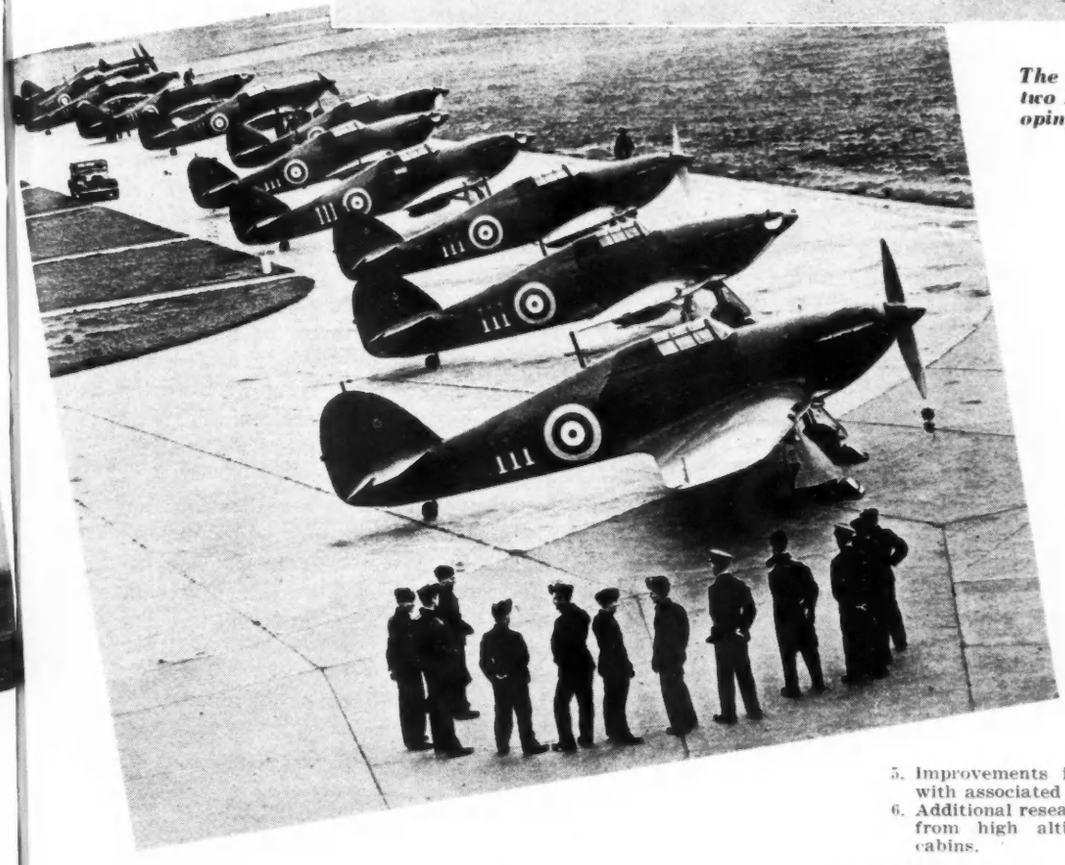
At the right is the Boeing B-17D powered by four 1200 hp. Wright engines with a top speed in excess of 300 m.p.h.



Three eight-hour shifts of engines and mechanics at the Douglas plant are rushing production on the B-19 bomber. It weighs 80 tons and has a cruising range of 7500 miles



A squadron of Spitfire fighting planes of the R. A. F. ready to take off are shown below



The Lockheed P-38 is powered with two 12-cylinder Allison engines developing 1150 hp. The propellers rotate in opposite directions

The need for this development was foreseen two years ago by Arthur Nutt, and we, among others, worked on the problem. This work is now helping our bombers get the altitude they must have, and we are manufacturing several thousand for the leading plane manufacturers. The inlet of the pump is so designed that vapor or gas is expelled from the impeller, while solid liquid passes through. A recent test on a bomber showed a ceiling of 23,000 ft. without the pump, and 36,000 ft. with the pump in action. A variable speed, high pressure pump is being developed to replace the hand wobble pump which is manually operated by the pilot in emergency, and which is very fatiguing at altitude.

Both the British and Germans are working along similar lines. Rolls-Royce uses a fine system automatically controlled through an aneroid barometer. Vapor lock is checked by using a pump and line of much greater capacity than the engine needs, so that a partial flow of fuel in the line will maintain power. Tests on the booster system are run by using gasoline in the tanks at about 105 deg. Fahr. and ascending rapidly, which causes accelerated boiling.

Among developments needed are:

1. Additional research on high altitude fuel systems.
2. Additional research on high altitude ignition systems.
3. Improved spark plugs.
4. A reasonable solution to the physiological problems of flight crews at high altitudes.
5. Improvements in remotely controlled gun turrets with associated director system.
6. Additional research on bailing out oxygen equipment from high altitudes, particularly from pressure cabins.

Much has been written about self-sealing fuel tanks. The Germans—the professionals—were much ahead of anyone else on this development, for a good reason. While we designed tanks that would be crash-proof for commercial safety, they were designing bullet-proof tanks for war. But we have already passed them. A German tank, shot down in England, has an inner fiber tank, then ⅛ in. of buckskin, then ⅛ in. of natural rubber. The rubber expands when in contact with gasoline and closes the hole.

The Firestone tank has five layers. Gunfire can produce holes three or more inches in diameter through a metal tank, as the metal flowers out. Firestone uses steerhide for strength and rigidity, and because tears are restricted without ripping. LA-100 is a special sealing material and is permanent in its sealing effect, but somewhat slow to act. Sponge rubber acts quickly, but is not permanent—the materials, therefore, supplement each other. The sponge rubber has non-communicating cells to prevent wick action. A Neoprene lining is used to keep gasoline from the sealing

(*Turn to page 352, please*)

Air Superiority

By JOHN C. PRICE*

SHALL we produce combat planes that can be turned out in vast quantities and produce them at once—or shall we build the best planes that we can design?

On this question there can be no compromise. The answer must be unequivocal. War leaves us no choice. To win, we must provide not only more planes, but the best.

Of course, it would be easier if we did have an alternative. How many problems would solve themselves if we could only sit back and say, "Let's build anything that will stay in the air a few hours just so that we can run planes of some kind off our assembly lines—lots of planes, right now!"

Easier still would be to concentrate on quality—on the fastest, strongest fighters and bombers with the biggest effective loads, no matter how long it takes. This is exactly the line on which our aircraft industry has been working for years. If we could continue on it, there would be no need for the automobile industry to take over the burden of airplane mass production.

On the other hand, the hard fact is that our civilization is assailed by an enemy with more good planes than are yet available to oppose him. Until his air superiority is not only offset but destroyed, peace is a long way off.

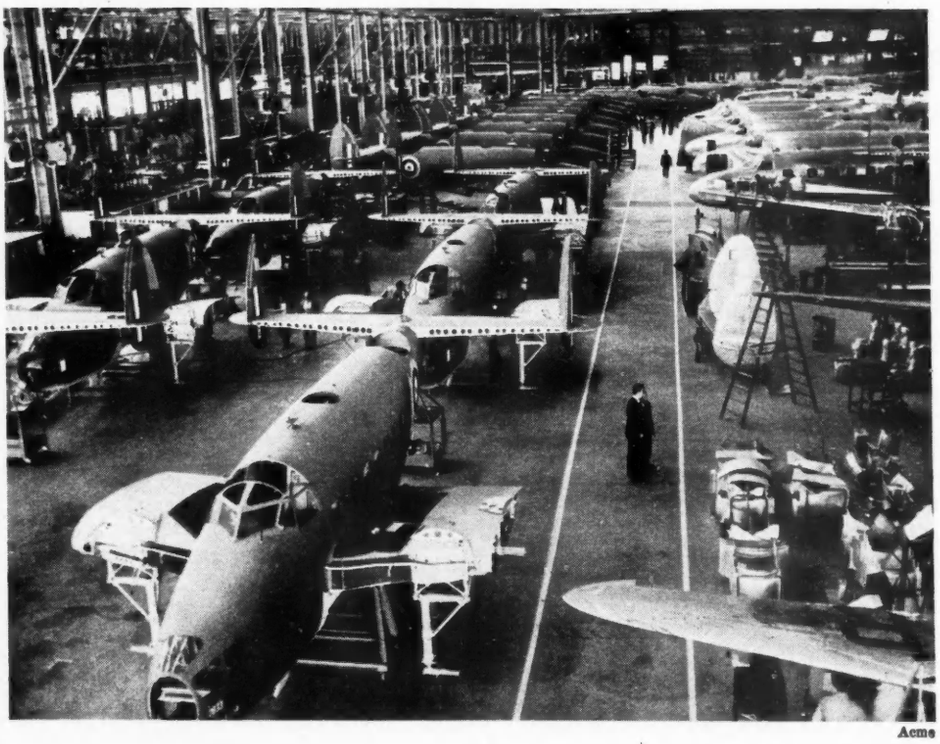
Those who would have us sacrifice the strength, power, speed, agility, range and stamina of our combat planes, in an effort to build more and faster, are not only demanding too great a sacrifice from pilots and combatant personnel, they are overlooking a vital tactical principle. In the air or on the ground, battles are won by remnants. The commander who has available the last surviving effective force to fling at his enemy almost invariably comes out the victor.

Even with pilots who are brave enough and crazy enough to fly orange crates with cardboard wings, we cannot overcome hostile air superiority by numbers alone. The attrition of inferior aircraft is too rapid. Their combat effectiveness is just enough less so that the surviving remnants of any force so equipped would face annihilation. Not only could hostile survivors beat them down, but actual failure of our own planes is altogether too likely at the very moment when we should be hammering down the last of the enemy.

Nor are plane production and plane performance alone to be considered. In the cold and cruel ratio of air superiority, there looms the factor of pilot training. It takes seven months to produce a fledgling pilot, seven months to replace him. Were we to forget completely our obligation to provide our aviators with the best planes we can build, self interest alone dictates no less.

A grim and sobering thought, this realization that we must not only build more planes but the best! Some people claim that only supermen can do it. One nation of 80,000,000 people has been working overtime for more than four years to prove that *they* are the supermen who *can* do it.

That is but one of the ways in which they have

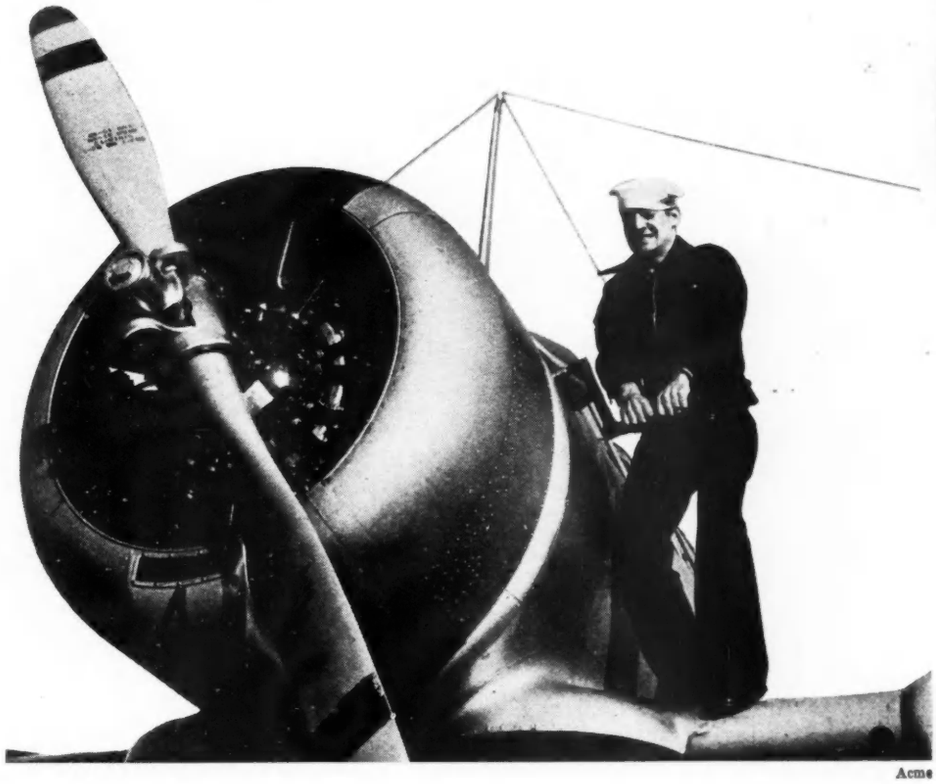


Acme

Lockheed Hudson bombers in the process of completion at Burbank, California, for delivery overseas

* Chief Sales Engineer of Jones & Lamson Machine Company.

Begins on the Ground



Acme

turned on the heat. No wonder we are beginning to feel it, and we shall feel it more. If the automobile industry is going to succeed in its patriotic determination to accept the challenge of plane production, it means not only harder work but planning that is high-powered, far-sighted, s h r e w d and continuous.

If anyone imagines the automobile builders cannot lick this job, let him look at their record. By 1910 the American public had ceased to regard automobiles as miracles and had begun to purchase cars in substantial quantities. At that time anyone desiring to buy a car had a choice. The choice lay between a fine car at a high price and a flimsy uncomfortable vehicle at a low price. The American motoring public was not satisfied with this choice. "Give us," they demanded, "a finer car than you now build at any price for less money than we now pay for any car!"

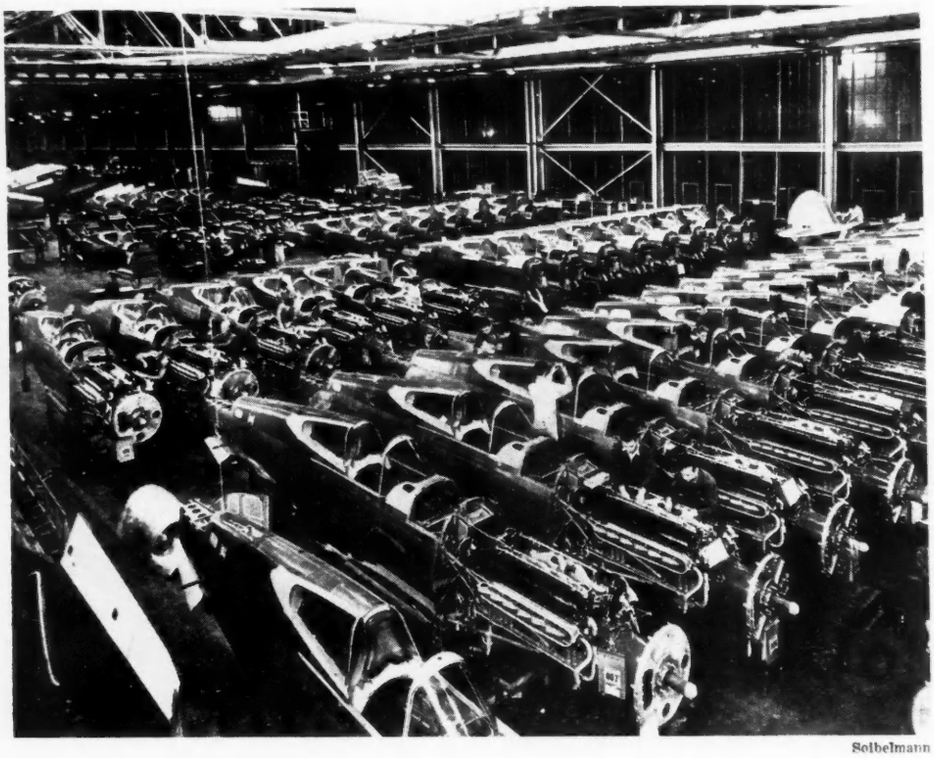
The industry met this demand in spite of business reverses, capital shortages, bitter competition, sales problems, and the necessity for developing completely new methods, building new machine tools and new plants to house them—all out of earnings! Of course, it took years, but look at the handicaps.

Compare the conditions under which the motor men did this job with the conditions now confronting them. There is no shortage of capital, no price competition, and no sales program. They have priority on all the tools and materials they need. They have the largest force of trained minds and skilled hands in the country. Passenger cars, trucks and buses now on our roads will keep rolling a little longer. The planes will be built, and they will not be jerry-built, either.

The first essential, of course, is to bridge the gap between automobile production methods and aircraft production methods. You do not necessarily have to have a lifetime of experience in planning machine tool work for both the aircraft and the automobile industries to see plainly that a meeting of minds between experts in both fields is essential.

Other machine tool men who read these lines have doubtless sensed such a need. Only recently you sat down to a stack of blue prints with an automobile production expert—a top flight man in his field, and you started to go through them. What happened? The automobile production engineer began to cut or completely eliminate operations. He suggested the re-routing of job after job, feeling honestly the while, no doubt, that he was only adopting the savings in time and cost that common sense and special experience dictated. He asked, for example, "Why must we put such a high polish on connecting rods?" On the basis of automobile experience this seemed pure waste. But only when you have seen connecting rods in airplane motors snap and break from a single file scratch do you begin to appreciate the delicacy of airplane engine work.

The radial air cooled engines now manufactured in America weigh a little more than 1 lb. per hp., will run in transport operations about 600 hrs. between overhauls and have a useful life of some thousands of hours. One of the critical points of these engines, when used in fighting planes, is the big end connecting rod bearing. The weight of the master rod big end and the revolving portion of the articulated rods produces bearing loads in the order of 6000 lb. per sq. in. in power dives. The connecting rods must be kept just as light as possible and this, in turn, means



Seibelmann

Curtiss P-40 pursuit planes for the U. S. Army and Tomahawk fighters for the R. A. F. are coming off the production line, 10 a day, at the Buffalo plant

very careful metallurgy, superb finish and inspection so that a very low factor of safety can be employed.

Now the finish used on these rods and their bearings has been only one of the points of attack by automobile production men. The rods are so heavily loaded and their factor of safety necessarily so low that they must be glass smooth lest fatigue cracks start in some minute scratch. Every part and fillet must be absolutely true to form and finish.

Any departure from this procedure would mean a heavier rod assembly which, in turn, would increase bearing loads. As the present bearings are loaded to capacity, and are of the finest quality obtainable regardless of cost, this means that they would have to be made larger. This would increase the weight of the engine.

The other alternative would be simply to admit that the engines built quickly probably would develop fatigue failures or other troubles if run long enough and to hope that this would not matter, as the machine would probably be shot down or wrecked, before any such failures could develop. The tactical weakness of such a policy condemns it out of hand.

Until these factors of tactics and design are appreciated as well as understood, it is useless to try to explain academically that unusual refinements are essential to produce faultless engine performance under two extreme conditions:

1. Vibration that is not absorbed by a heavy chassis and four balloon tires resting on the solid ground, as in an automobile.

2. Reduction of weight in all working parts to an absolute minimum.

Of course, the automobile production man knows these things, but some have not sensed them as perilous facts for which incomplete allowance is as fatal as no allowance at all.

There are times when no amount of technical background can take the place of those sensations which alone can make a man truly aware of the tremendous differences between a motor car and the overgrown butterfly which we call a combat plane and which must carry a powerplant strong enough for several 10-ton trucks.

To make this even more clear, let us revert to a familiar comparison. Anyone who has stood on the after deck of a pitching steamship has felt the jar of the thrashing propeller when the stern was heaved clear. The same stresses that make a steel ship quiver are present and multiplied in a plane whose powerplant is relatively so much greater and whose body must be built so much lighter and still hold together in battle. Sometimes it takes more than blue prints to make men aware of realities like this.

Recently there was discussed with us the problem of increasing production on the numerous small gears needed to drive motors, starters, pumps, etc., on an aircraft engine. Each little gear goes through an elaborate cycle of operations, during which it is turned and faced all over, then carburized, then certain surfaces have the carbon removed, then back to have the gear faces hardened and then finally the remaining surplus stock is removed from the web of the gear to reduce weight.

Of course, no gear in an automobile ever needs so many operations, for what difference does it make whether the gears in a sedan are a little heavier than absolutely necessary to transmit the motor's horsepower to the rear axle?

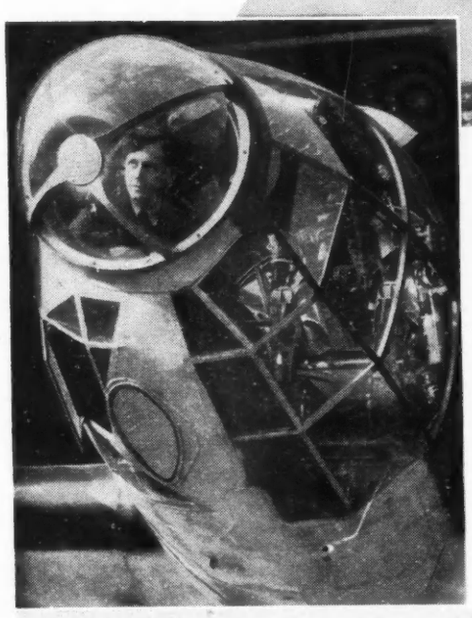
In a war plane the lives of pilot and crew, to say nothing of the success of their combat mission, may depend on the presence of an extra gun in the fuselage or even a few additional rounds of machine gun ammunition. That's why the gears in aircraft motors are pared down to minimum weight. That's why tooth and shaft must be in perfect alignment so that there will be no distorting strain that will break the gear and stall that motor at the very instant when the pilot

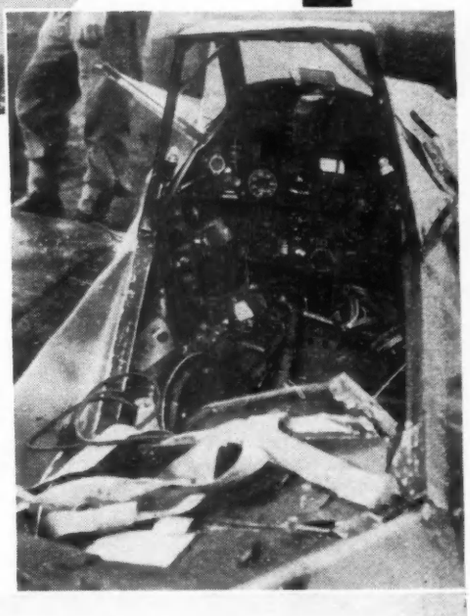
(*Turn to page* 360, *please*)

Axis Planes "in Dutch" in Britain

WRECKAGES of Axis bomber and fighter planes in Britain are giving British aviation experts eagerly accepted opportunities to observe what construction and equipment the enemy is using in its raiders.

To German fighter pilots the hazards are great. Such was the case with a Messerschmitt that was blown to bits when it exploded high in the clouds. Its bomb, unlike those in the bombers, was not protected, and when a machine gun bullet from a Spitfire hit it, that was the end of another menace to the British. The engine and propeller of the Messerschmitt landed a mile away and its tail two miles from the explosion. The fuselage and wing were demolished completely, but the instruments in the cockpit (below) remained intact as mute evidence of the flight.





(Top) An Italian fighter plane stops on its nose.

(Left) Looking into the nose of a Heinkel III.

(Right) The Messerschmitt 109 cockpit with its instrument panel intact.

(Lower) A Junkers 88 came to rest and immediately was placed under guard.

British Combine Photos

More Aircraft

IN HIS PAPER presented at the National Aeronautic Meeting of the S.A.E., Henry C. Hill of Wright Aeronautical Corporation, said that to many people the flood of conflicting information on the airplane engine situation in this country is bewildering. Even those in the industry are not in complete agreement as to the best course to pursue in building up our military aviation.

Most puzzling perhaps are two questions: First, if the United States produces the world's best airplanes, and if the United States leads the world in technology of mass production, how can it be said that she is so far behind Germany in air strength?

And second, since American airplane engines have been, and still are, more widely used throughout the world than those of any other nation, how is it that engine production may be the bottleneck of our defense program?

The answers to these questions are not as simple as some who volunteer information would have us believe. The causes of our present situation are certainly not political, nor can it be said that the aircraft industry in this country is lacking in ability or foresight; nor, for that matter, can it be said truthfully that we are actually in a dilemma. The facts of the matter go much deeper and are inextricably bound up in the technical or engineering aspects of the airplane.

As the power of the engines increased per pound of weight, and as reliability improved, the airplane itself was also improved and the resulting vehicle began to attract world-wide attention by demonstrating its ability to carry substantial loads for long distances, at speeds that seemed fantastic. People with imagination foresaw, first, the tremendously destructive military possibility of aircraft, and, second, a new era in transportation of people and goods promising to shrink the map of the earth to terms of hours and days instead of weeks and months.

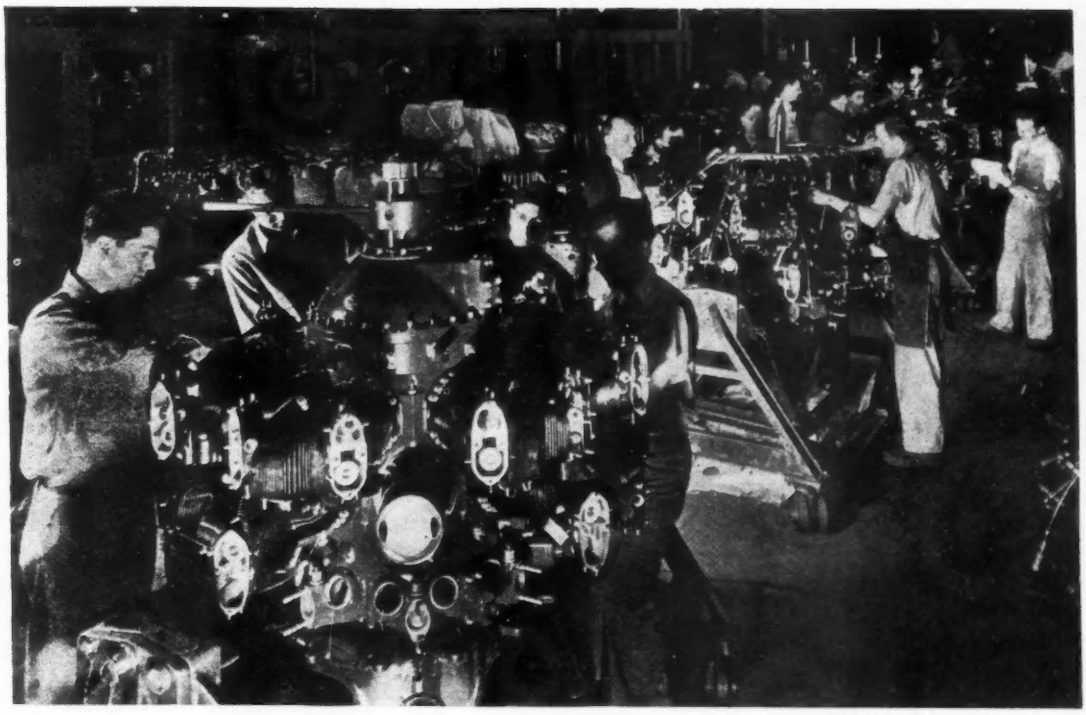
In this country, the transportation appeal was predominant. Not that the military side was entirely overlooked, for a few farsighted men in our Army and Navy aviation did much to foster experimental development of combat aircraft and engines. Some of our battle planes were prototypes for the European aircraft of the present war. But as a nation we were not interested in that phase. It was only in Germany that the military power of aircraft was fully appreciated. Only in that country was the military airplane given the primary emphasis at the expense of commercial development. To Germans the meaning of the increasing payload of the modern airplane was greater bomb loads; the meaning of higher speeds, greater range of military action and swifter results. This is a significant clue to the answer for the first question we stated at the beginning, namely, why is our air force so far behind Germany's?

That we did a good job in this country on our transport airplanes and engines is attested by the fact that all nations have come to us for their airliners. We know also that the efficiency and dependability we have attained in these airplanes and engines will serve us well for military purposes by substituting bombs, guns, armor and ammunition for the present payload of passengers, mail and express. This is not a simple job by any means because the modern airplane is an extremely complex machine for all its simple and sleek outward appearance. But diverting our design and construction efforts from commercial military aircraft is relatively easy compared to the main problem confronting us—which is *mass production*. There was no mass production in aircraft or aircraft engine manufacture before Germany tried it. It is a striking fact that airlines as we know them now do not need many airplanes to carry on a very substantial traffic. The reason for this is that the airplane completes its trip so quickly that many more trips are possible with the same airplane in a given period of time, than with the train, or the automobile.

So we have been used to producing 200 or 300 engines per month, where now we need to produce 2000 to 3000 per month. In other words, we must increase our rate of production approximately 10 times. To most people this increased production rate is merely a matter applying the well-known production methods of the automobile industry. This naive statement has just enough truth in it to confuse the minds of many people both inside and outside of the aviation industry. Between the statement and the actual fact the gulf is very wide indeed. It is true that the principles developed by the automobile manufacturers must be applied to aircraft and engine production, but we are sure that it is equally true that these principles must be modified and further developed to suit the new set of standards and the new tempo required in the aircraft field. Whether we like it or not we must face the fact that in developing the aircraft engine we have also developed a *brand new design and manufacturing technique*, which is as far removed from automobile manufacture as the automobile was from carriage building.

We are sure that there can be absolutely no sacrifice in quality and still have a successful airforce, for without dependability in the engine the airplane is worse than useless as a fighting machine.

What is the new technique required to manufacture good aircraft engines in large quantities? You hear it said that the trouble with the aircraft engine indus-



Mechanics are shown assembling powerful Wright Cyclone engines of 1,600-1,700 h.p. in the final assembly department of the Wright Aero-Corp. in Paterson, N. J., which has just announced that its airplane engine production now totals more than 1,000,000 horsepower monthly, and that peak production in its five Northern New Jersey plants will be reached late this spring.

Engines for Defense

try is that we make too many changes in design, that we have got to "freeze" our engine design in order to build large quantities. This is probably the greatest misconception of all. The one sure way to wreck all engine production efforts is to adopt a policy of "frozen" design. Not only would this effectively throttle large scale production, but it would also insure that our engine and airplane performance would shortly become hopelessly obsolete.

The new technique required to manufacture good aircraft engines in large quantities involves recognition of the methods which have made it possible to develop the modern engines and produce them in small quantities. They include: (1) use on a grand scale of research, experiment and proof testing under constant pressure to produce practical results; (2) use of the finest materials and manufacturing processes; and (3) provision of flexibility in the manufacturing scheme for the continuous introduction of detail improvements as they become available. This last item deserves profound study, because lack of consideration of its implications may dangerously retard production efforts.

The principal significance of all three of these special requirements has been their staggering cost. Machinery required for testing engines in the laboratory under the lower atmospheric air pressures and temperatures, to simulate flight at high altitudes, is extremely complex. Flight-testing a 1700-hp. engine may cost as much as $300 per hour for a multi-engine plane. Even endurance proof-testing on the ground costs about $75 per hour, and at least 2000 hours is required before quantity production can be safely considered.

Airplane engine engineers have been quick to take advantage of the rapid progress made in metallurgy. An astonishing number of detail design changes are made during the course of engine production, to take immediate advantage of any improvements suggested by research or service experience. In addition, more complicated features are constantly being introduced in production processes. Some interesting examples of the latter are nitrogen-hardening for cylinders, grinding of threads, spectroscopic analysis of castings, Magnaflux magnetic inspection for cracks in steel, x-ray inspection of magnesium and aluminum castings, x-ray inspection of bearings, and the use of the Profilometer for exact inspection of surface finish. The airplane industry has learned to accept changes, and in some measure it has learned how to reduce the cost of making them. On the other hand, it has had little experience with real mass production.

Mass production is generally thought of as a carefully organized and highly integrated progress of producing, in relatively short time, large numbers of parts which are *all exactly alike*. It is overlooked that even in mass production changes in design are more or less frequent. If the parts are made fast enough, a definite proportion of the total working time can be allocated to changing tools and fixtures as required when changes in design are made. It is this principle that must be studied, amplified and organized to make possible the large-scale production of superior aircraft engines.

New Lycoming Aircraft

LYCOMING DIVISION OF AVIATION MANUFACTURING CORPORATION has recently brought out four new models of horizontal-opposed aircooled engines for light aircraft, ranging in output from 100 to 175 hp. Two of the engines have four, and the other two six cylinders each. The principal specifications of these engines are given in the accompanying table.

The cylinder assembly of each model consists of an aluminum cylinder head screwed and shrunk to a steel cylinder, both the cylinder and the head having integral cooling fins. Cylinder assemblies are fastened to the crankcase by means of studs and nuts. Each cylinder head has two spark plugs installed in spark-plug bushings of aluminum bronze, screwed and shrunk into the head casting at opposite sides of the combustion chamber.

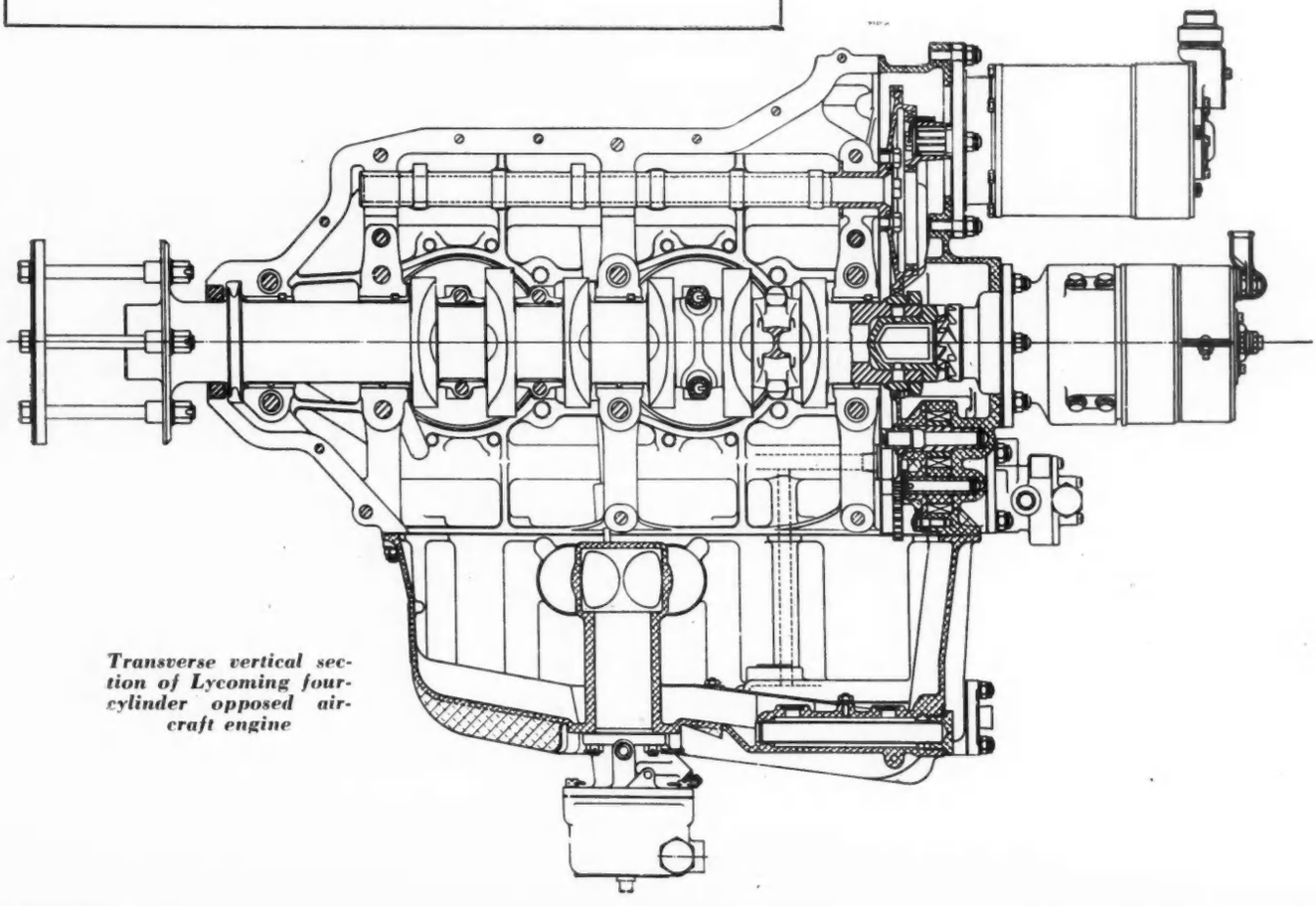
Pistons are cast of aluminum alloy and are heavily ribbed under the heads, to improve their heat-dissipating properties. Each piston carries two compression and two oil-control rings. Piston pins are of the full-floating type and provided with aluminum-alloy retaining plugs; they are 1⅛-in. in diameter. Connecting rods are alloy-steel forgings of H section. At the small end there is a bronze bushing, while the big end is provided with split bushings of the steel-back, copper-lead-lined type.

The crankshaft is forged of alloy steel and is hardened on all bearing surfaces. Four-cylinder shafts are supported in four main bearings, six-cylinder shafts have five. Crankshafts are statically and dynamically balanced and are drilled with oil passages and for lightness.

The crankcase consists of two aluminum-alloy castings, being split on

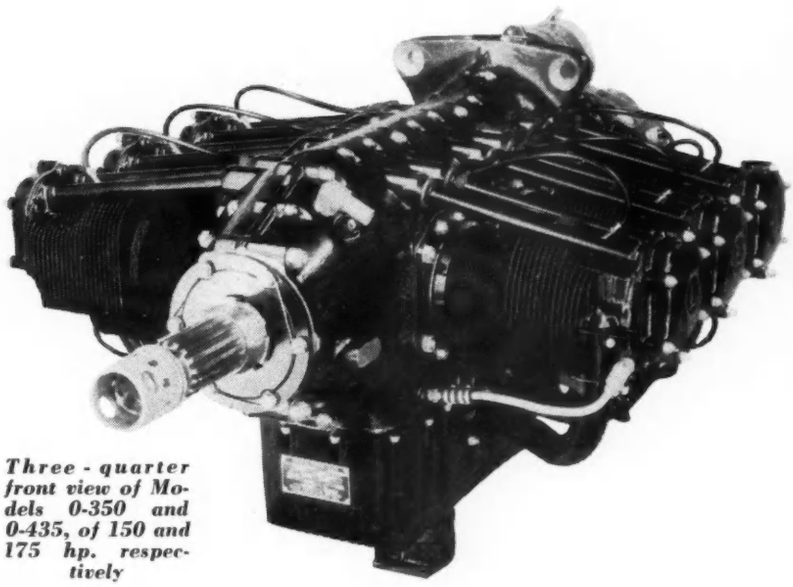
LYCOMING HORIZONTALLY OPPOSED AIR-COOLED ENGINES

Model	O-235	O-290	O-350	O-435
Number of Cylinders	4	4	6	6
Bore, in.	4⅛	4⅞	4⅜	4⅞
Stroke, in.	3⅞	3⅞	3⅞	3⅞
Displacement, cu. in.	233	289	350	434
Compression Ratio	6.25	6.25	6.25	6.25
Rotation	R. H. Tractor	R. H. Tractor	R. H. Tractor	R. H. Tractor
Width, in.	32.38	32.38	32.38	32.38
Length, in.	33.19	33.19	40.85	40.85
Height, in.	25.0	25.0	26.25	27.75
Weight, lb.	223	233	325	332
Rated Power, b.p.	100	125	150	175
Rated Speed, r.p.m.	2500	2500	2500	2300



Transverse vertical section of Lycoming four-cylinder opposed aircraft engine

Engines



Three - quarter front view of Models 0-350 and 0-435, of 150 and 175 hp. respectively

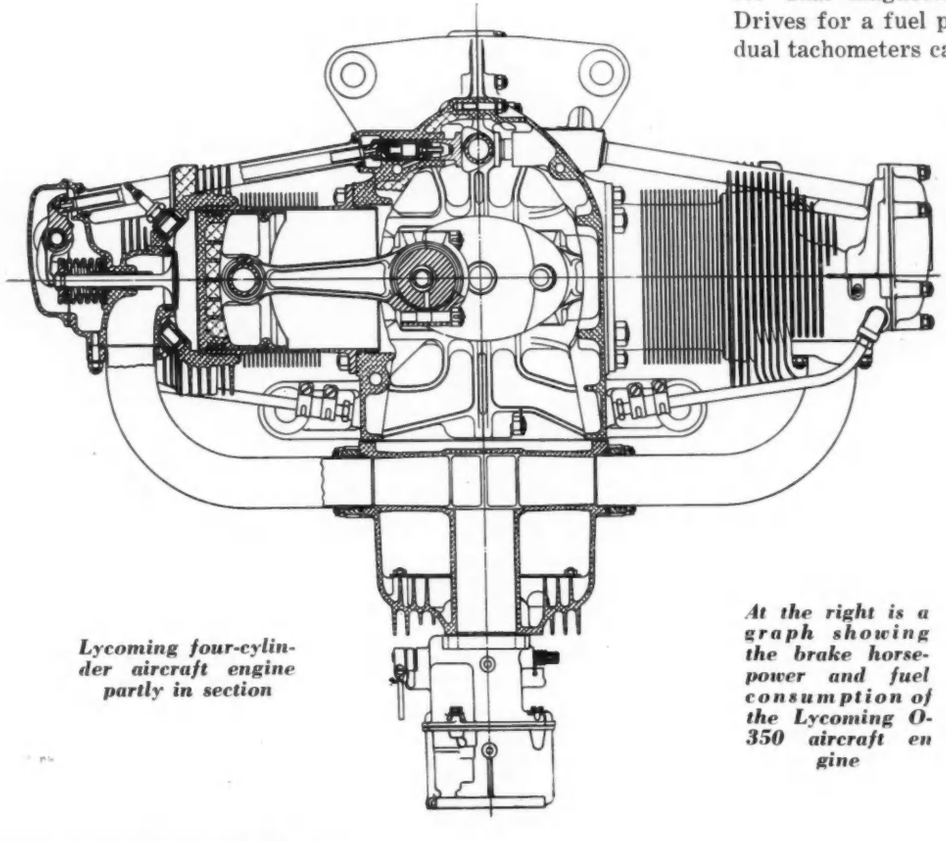
the vertical center line through the main bearings. There are four steel-back, copper-lead bearings in the four-cylinder models, while the six-cylinder models have an additional ball thrust bearing at the forward end of the case. The halves of the crankcase are secured together by means of studs and nuts. They are heavily ribbed to combine rigidity with light weight.

The camshaft is a steel forging and has a central drill hole extending entirely through it. Mushroom-type hydraulic tappets are used in all models, and the entire valve gear is lubricated by pressure. Pushrods are of steel tubing and have hardened ball ends. Rocker arms are made of steel forgings and are supported on floating pins in the cylinder head. One inlet and one exhaust valve are used per cylinder. Dual valve springs are secured with split-type valve keys and tapered collars. All valve-gear lash is taken up automatically under all operating conditions.

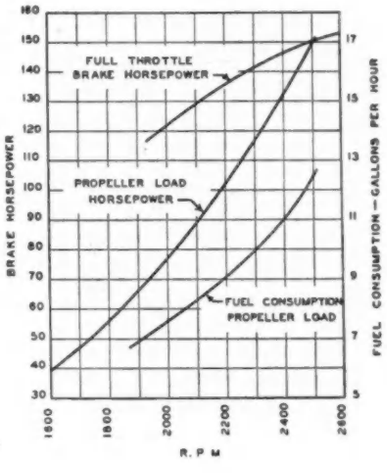
A single-barrel carburetor is secured to the oil sump. The distributing part of the induction system is integral with the sump casting and is submerged in oil, the effect being that of a heat exchanger, the oil being kept cool and the mixture warmed sufficiently for satisfactory distribution and cold-weather operation. All models are equipped with dual magnetos, which are driven from the timing gears through spur gears. Main and connecting-rod bearings, and those of the valve mechanism, have full-pressure lubrication. There are centrifugal sludge removers in all crankpins. Pistons, piston pins and accessory-drive gears are lubricated by splash. Four-cylinder models have an oil capacity of 8 quarts and six-cylinder models, 12 quarts.

Accessories furnished with the engine include drives for dual magnetos, starter and single tachometer. Drives for a fuel pump, vacuum pump, generator and dual tachometers can be furnished as extra equipment.

The engine weights given in the accompanying table include dual magnetos, carburetor, and starter drive. If all of the optional drives listed in the preceding paragraph are included the total weight of each engine is increased 2 lb.



Lycoming four-cylinder aircraft engine partly in section



At the right is a graph showing the brake horsepower and fuel consumption of the Lycoming O-350 aircraft engine

The third member No. 66A assemblies are carried on this carousel conveyor.

View showing front axle final assembly line No. 66A.

Thirty-Five on Buick

MOVEMENT of parts and subassemblies in process of manufacturing front suspension systems and rear axle units is brought to a high degree of refinement in the new axle plant erected for 1941 production by the Buick Motor Division at Flint, Mich. Thirty-five separate and distinct conveyor systems are synchronized and coordinated to handle this flow of material, in addition to a main delivery conveyor which transfers front suspension systems and rear axle assemblies from the axle plant to shipping and storage, this conveyor being somewhat over a mile and

Functions of Sub-

No.	Length Feet	Hook Spacing Inches	Pieces Per Hook	Speed Feet per Minute	Name and Use of Conveyor
1	880	16	6	5–15	Ring gear—Carries ring gears from turning and drilling to tooth cutters.
2	384	16	6	5–15	Drive pinion—Carries drive pinions from turning and boring to tooth roughers.
3	360	24	36	5–15	Side gear—Carries bevel side gears from chucking operations to tooth cutters.
4	350	24	36	5–15	Finish side gear and pinion—Carries bevel side gears and side pinions from cutters through washer to burring and inspection.
5	360	16	6	5–15	Drive pinion semi-finish—Carries drive pinions from tooth roughers through tooth finish generators.
6	480	16	6	5–15	Drive pinion finish—Carries drive pinion from tooth generator through washer to burnishing and inspection operations.
7	416	16	6	5–15	Finish cut ring gear—Carries ring gears from finish tooth cutters through washer to inspection benches.
8	1260	16	6	5–15	Heat treat and storage—Carries finish cut ring gears and drive pinions from burnishing and inspection to heat treat.
9	300	24	6–Rings 6–Drive pinions 36–Side gears	3–	Heat treat—Carries all hardened gears from oil quenching operations to cleaning operations. Gears then are moved by special rack trucks to grinding department. (This conveyor operates in heat treat department only.)
10	600	32	10	5–15	Differential case—Carries cases from inspection benches to ring gear and case assembly presses. Also used as a moving storage bank.
11	260	24	8	5–15	Finish ground ring gear—Carries ring gears from grinding department to ring gear and case assembly presses.
12	296	16	1–Ring gear and case 1–Pinion	6–	Ring gear and case assembly—Carries these assemblies through ring gear and drive pinion set lapping.
13	590	24	1–Ring gear and case 1–Drive pinion		Ring gear drive pinion set—Carries these items plus side gear and side pinion from above lappers (side gears and pinion from grinders) through a washer and into final gear set matching and sound testing room; then outside to complete assembly of differential gear case (side gear, side pinions, axle pins, bushings, etc.); from here onto truck racks in sets of 50 and trucked in trains to third member subassembly line.
14	624	24	6–Knuckles 12–Arms 1–Complete subassembly	2– 6	A-Frame parts stock—Carries knuckles, steering arms and A-Frame subassemblies from machining floor to subassembly area, then through washer to front shock absorber subassembly.
15	260	24	6	2– 6	Front wheel hubs—Carries front hubs from machining area through washer, then to front hub and brake drum subassembly.

a quarter, or 6634 feet to be exact.

The accompanying tabulation shows 32 of the subassembly conveyor systems, identifying their function and starting length of the cabin, hook spacing and number of parts carried, as well as the speed range. In addition to these, the following conveyor systems have been installed:

1. A carousel-type conveyor assembly of third members comprising torque tube, flanges, propeller shaft, bearings, etc. Capacity of this conveyor is 45 to 135 jobs per hour. It is 136 feet long and has 39 saddles or fixtures spaced at 4-

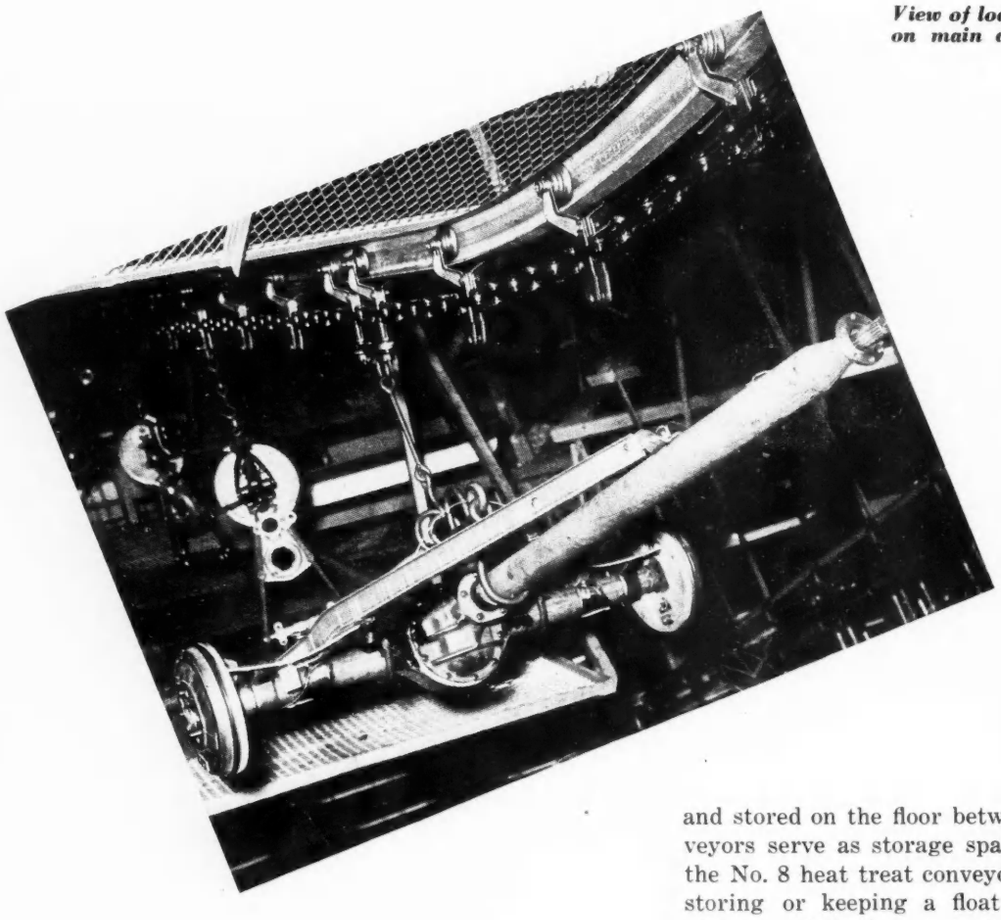
Conveyors Axle Line

General view showing as much of the No. 66A line as could be obtained in a single exposure.

A view showing the rear axle final assembly line No. 66A.

Assembly Conveyors

No.	Length Feet	Hook Spacing Inches	Pieces Per Hook	Speed Feet per Minute	Name and Use of Conveyor
16	130	32	4	2- 6	Front drums—Carries front wheel drums from above hub and drum assembly presses through finish turning and balancing operations. (Turn on stub lathes, balance on dynamic balancing machines.)
17	350	32	4	6-18	Front hub and drum subassembly to front suspension assembly line from above balancing machines.
18	268	24	8		Rear axle shaft and drive assemblies from subassembly through finish turning stud lathes.
19	78	24	8		Rear axle shafts and drum from above turning lathes to balancing machine.
20	252	24	4	6-18	Brake drums—Front and rear brake drums from machining area to front hub and drum and rear axle shaft and rear drum subassemblies.
21	270	24	8	4-12	Axle shafts—Carries finished machined axle shafts through washer and inspection to rear axle shaft and drum subassembly area.
22	716	24	8	4-12	Rear axle assembly feeder—Carries rear axle and drum subassemblies from balancing machines to rear axle final assembly line.
23	280	24	8	....	Axle shafts from straightening machines through lathes, spline hobbers and grinders.
24	145	24	8	6-18	Axle shaft straightening—Rear axle shafts from tumbling mills (After annealing in heat treat) through straightening machines.
25	544	24	6	4-12	Propeller shaft assembly feeder—Carries propeller shafts from the proper stub and coupling assembly welder to the drive pinion subassembly.
26	152	24	1	4-12	Torque tubes from flange and tube assembly welding to radius rod clip welders.
27	138	24	1	4-12	Torque tubes from above welders to primary drilling machines.
28	304	32	6	....	Differential carriers from end of machining line through washer to torque tube and carrier subassembly.
29	500	16	1	4-12	Differential carrier and torque tubes from above subassembly to third member subassembly. Above tube and carrier subassembly is transferred from conveyor No. 29 to a carousel type conveyor and the propeller shaft and drive pinion subassembly is assembled, also differential gear case subassembly. This constitutes a complete third member unit which then is sound tested and finally goes to rear axle assembly line for assembly into axle housing.
30	108	8	1	8-24	Carries propeller shaft and drive pinion subassemblies through the straightening presses and dynamic balancing machines.
31	154	24	1	4-12	Third member assembly feeder—Carries above propeller shaft drive pinion subassemblies to the above third member assembly carousel conveyor.
32	144	16	1	3-10	Third member assembly from carousel conveyor through sound test room.



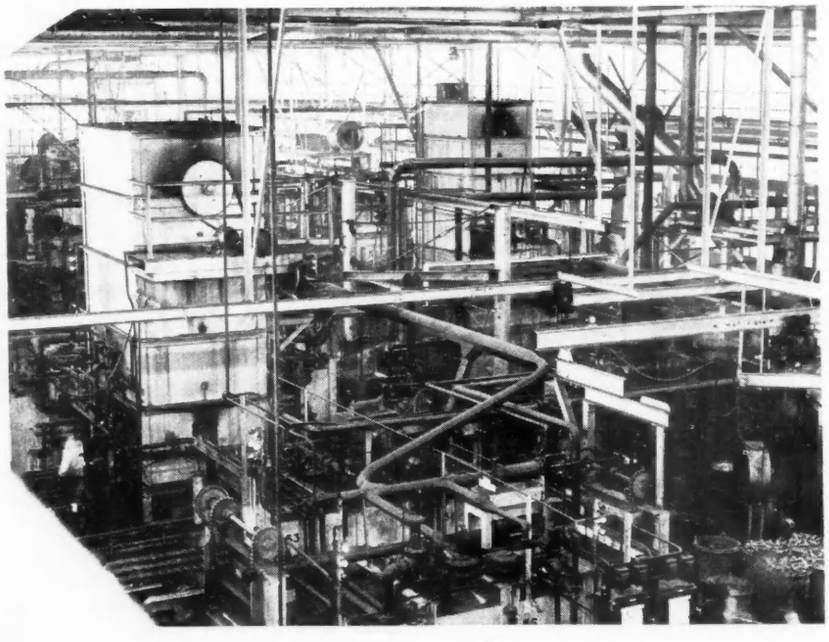
View of loading front and rear systems on main delivery conveyor No. 66A.

foot intervals, each carrying one piece. Operators work both inside and outside the loop as it makes a circuit, speed being variable from 3 to 9 feet per minute.

2. The front wheel suspension assembly line, a power driven conveyor with fixtures on each side. Working length is 120 feet, requiring a 240-foot chain. Fixture spacing is 24 to 30 inches, alternate left and right, of a 54-in. job space. Each fixture accommodates one suspension unit and the conveyor speed is variable from 3 to 9 feet per minute.

3. The rear axle assembly line also is a power driven conveyor with saddle-type fixtures, the axle riding crosswise with propeller shaft and torque tube parallel with conveyor. To keep pace with the front suspension assembly line, a longer conveyor is required, 238 feet or 476-foot chain. Speed is increased over the front line to 5-15 feet per minute.

With this comprehensive system of parts movement, it is estimated that a saving of one-third has been effected in floor space compared with that necessary if parts were to be handled by truck, and stored on the floor between operations. How conveyors serve as storage space is shown effectively by the No. 8 heat treat conveyor, which has capacity for storing or keeping a float of 3000 ring gears and pinions. This is required because of the fact the heat treating department must operate 24 hours a day, while the machining department usually operates only two 8-hour shifts, in this time, building up a sufficient float to keep the heat treating furnaces busy for a third shift.



The heat treating department must operate 24 hours a day. It has storage for 3000 ring gears and pinions.

PRODUCTION LINES

Machine Steel

Perhaps the most noteworthy accomplishment of the people producing cemented-carbide tools, of which Carboloy is an outstanding example, is the recent introduction of steel-cutting compositions. This is more startling than it sounds, since steel cutting was not considered within the province of cemented-carbide tools up to a short time ago. Steel cutting carbides happily fill an important place in the National Defense program. One of the big problems from now on will be the tooling of existing machinery for more intensive productivity, since the manufacturers cannot depend upon getting new equipment at will. These tools when applied to modern machinery will greatly speed up the rate of metal removal and thus will compensate for the inability to get new production machinery. Needless to say, when these alloys are applied to the latest crop of machines they provide an order of productivity hitherto unknown.

Defines Terms

First edition of the new Chambers' Technical Dictionary, just off the press, aims to provide, in the light of present knowledge and opinion, definitions of terms that are of importance in pure and applied science, in all branches of engineering, and in the larger manufacturing industries. Edited by C. F. Tweney and L. E. C. Hughes, it represents the contributions of recognized British scientists and technical experts. Since technical terms are special symbols designed to facilitate the precise expression and recording of ideas, this dictionary should become an important part of the library of engineers, research men, executives, advertising men, and others. An authoritative reference work of this nature can do much to promote sound usage—eliminate the foggy impressions which ofttimes mar the interpretation of technical writing. The dictionary is published by The Macmillan Company, N. Y.

Bottle Necks

Intelligent manufacturing executives realize that the biggest bottleneck facing them will be that of trained labor. Trained mechanics can't be pulled out of a hat by a prestidigitator. And yet the overall good cannot be served by robbing one establishment in order to help another. Most hopeful sign on the horizon is the zeal with which government, industry, and educators have got together to produce a vast network of facilities for quickly training men for the national defense program. Many agencies are contributing their talents to this end. Most of the important industrial establishments have pitched in with a will. Entire communities have enlisted in this effort and organizations like the ASTE have publicized comprehensive and well planned programs which are being adopted whole-heartedly.

On Substitutes

It is absorbing—albeit disturbing—to watch the shifting picture of metallurgy and even engineering design due to the rationing, if not a shortage in some instances, of basic materials. We see and hear comments concerning the replacement of Nickel, of Zinc, of rubber-replacing materials, of other things. One result of this shuffling of the deck will be the development and perhaps the acceptance of those substitute materials which prove their utility and economy by contrast. We have all been conscious of the competition of materials, of processes, and the like but now there is a play of forces quite beyond the normal impacts of a free competitive system. In this situation some people with imagination will seek and find ways of preserving the position they built up at so much cost over a period of many years.

Chemical Gloves

Small but fruitful chemical organization has developed a number of products which serve as chemical gloves—in some instances to protect workers against occupational hazards, in others to protect the products from acid perspiration corrosion. One group of such preparations is used for coating the hands and arms of machine operators to prevent skin eruptions due to contact with cutting fluids and other industrial oils. This material is emulsifiable in water and washes off without difficulty, thus promoting personal hygiene. The other type of product is a thin water-like colorless, soluble material, which inhibits perspiration. This makes it possible for machine operators, inspectors, packagers, etc., to handle finally finished parts without the usual danger of rusting due to perspiration. Such chemical gloves are a valuable adjunct in metal working operations, particularly under the stress of national defense activity.

Fuels and Lubes

There is a growing bond of cooperation between engine builders and the petroleum producers refiners. The day of the high pressure salesman is past; the day of the trained technologist is here. Motor vehicle producers and operators are faced with seemingly baffling problems — bearing corrosion, sludge, varnish, and whatnot—but the recent meeting of the American Transit Assn. proved conclusively that an honest and intelligent cooperative approach can and will resolve these difficulties. The best evidence of the spirit in the air is that engineers welcome the informed petrolum technogolists; and that both sides are willing to lay their cards on the table.

Lube Tax

One of the evils of slip-shod thinking and reliance upon preconceived notions has come home to roost in the form of the lubricating oil tax which is imposed almost without reservation on all types of cutting fluids. Because the material used in much of the cutting fluids is produced by petroleum refiners and because from time immemorial the function of a cutting fluid has been considered as being that of lubrication, the users of cutting fluids pay a tax of 4½ cents per gallon—through application of the federal law which imposes this levy on motor vehicle lubricants. It is our opinion that the just way to administer the present law is to specify exactly which metal cutting operations do indeed involve lubrication to an important degree—and to isolate those specific applications in which lubrication is not a function. However, we appreciate that the burden of proof is upon the user. It is up to industrial users of cutting fluids to make a scientific study, then to present the facts to Internal Revenue officials for a ruling as to valid exemptions. The fact that *lubrication* is a function of some cutting fluids on known operations does not imply that all cutting fluids and all metal cutting operation involve lubrication.

Expander Rings

Our attention has been drawn to a little booklet issued by the research staff of the Ramsey Accessories Mfg. Co., dealing with the features of expander type piston rings. It describes the advantages of such rings in high performance engines, cites some dynamometer tests as proof. We can get you a copy of this booklet on request.

Grinding Speeds

That the range of grinding wheel speds on disc grinding operations should be revised downward is the recommendation made by the Gardner Machine Co., in a recent issue of the *Gardner Grinder*. Suggested wheel peripheral speeds are of the order of 5000 to 5500 sfpm and as low as 4200 sfpm. Any intimation of problems of checking, burning, or distortion of work demands a careful study of spindle speeds.—J. G.

IN FEW if any other industrial fields has there been greater research development and application of the products during the past few years than in the rubber industry. And as the world conflict spreads with greater intensity, the supply of rubber is becoming more and more vital, both for commercial and military uses.

The limitations of natural rubber appear to be definitely established and in recent years technologists have turned to the development of synthetic rubber. From this research has emerged such products having improved properties, as Neoprene, Thiokol, Perbunan, Buna S, Ameripol, Hycar, Chemigum, Koroseal and Vistanex. As rubbers are modified by the addition of other materials to fit them to certain uses, the commercial products of these synthetic rubbers also have various compositions.

Mechanically, present synthetic rubbers are not claimed to be superior to natural rubber, but do surpass it in resistance to gasoline, oil and other organic liquids, and also to deterioration by sunlight and oxidizing agents.

Another approach to the problem of conserving rubber supplies has been under way at the Akron laboratories of the B. F. Goodrich Co. and these efforts have been rewarded by the discovery of a new compound, Duramin, which is said to improve the properties of rubber products considerably. When used in natural rubber products, it toughens them to wear and prolongs their serivce life by retarding oxidation, the prime cause of premature aging. So effective is Duramin in tires that only a minute amount ranging from ¼ of 1 per cent to 2 per cent of the rubber is necessary. To synthetic rubber products it imparts some of the qualities of natural rubber. Duramin is used in the 1941 Silvertown tires of the Goodrich company.

High-Bismuth Alloy For Shell Machines

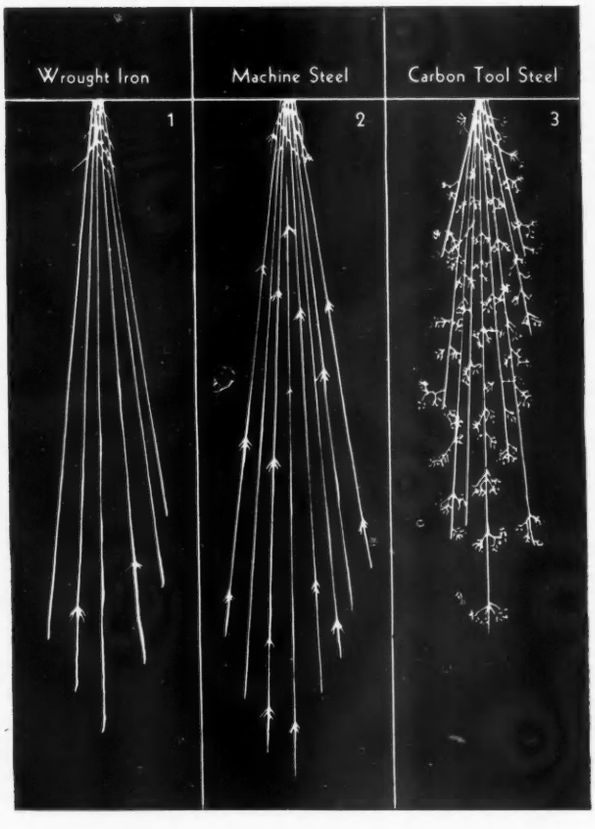
A LITTLE known alloy, said to contain about 50 per cent of metallic bismuth and the remainder about half lead and half tin, is finding a significant use in the new shell machines designed by the Machine Tool Builders' Association as one of its contributions to the rearmament program. These machines are described under MEN and MACHINES on page 342.

This alloy is employed to hold bushings and bearing sleeves in cored holes in the sand cast frame, its utility resulting in part from the fact that the alloy expands slightly upon cooling. In so doing, the alloy, which is used to fill the annular space around the bushings, binds the bushing securely to the casting. The alloy is poured while the bushings are held in place in a jig designed for the purpose. The practice makes it unnecessary to use a boring mill to machine the cored holes, which, because of this, require no machining at all and result in a corresponding reduction in cost. It is not unlikely that similar savings might result by following similar practice in other equipment which the automotive industry requires in tooling for armament production. The alloy is a product of the Cerro de Pasco Copper Corp., New York.

Rincontrol Is New Wrinkle Type Finish

FOR manufacturers who prefer a textured enamel finish on their products, Roxalin Flexible Lacquer Co. of Elizabeth, N. J., offers Rincontrol, a new wrinkle type finish of fine texture and comparative smoothness. Among the features claimed for it are

Automotive MATERIALS 49



one-coat finish, permits the use of rougher sheet metal, eliminates primer and surfaces, castings and sheet metal finishes with it have the same appearance, good adhesion, sufficient flexibility to permit mild forming, and resistance to salt spray, humidity, perspiration, abrasion and marring. It can be used on sheet steel, die castings, aluminum and wood.

Bearings Lubricated By Vaporization Method

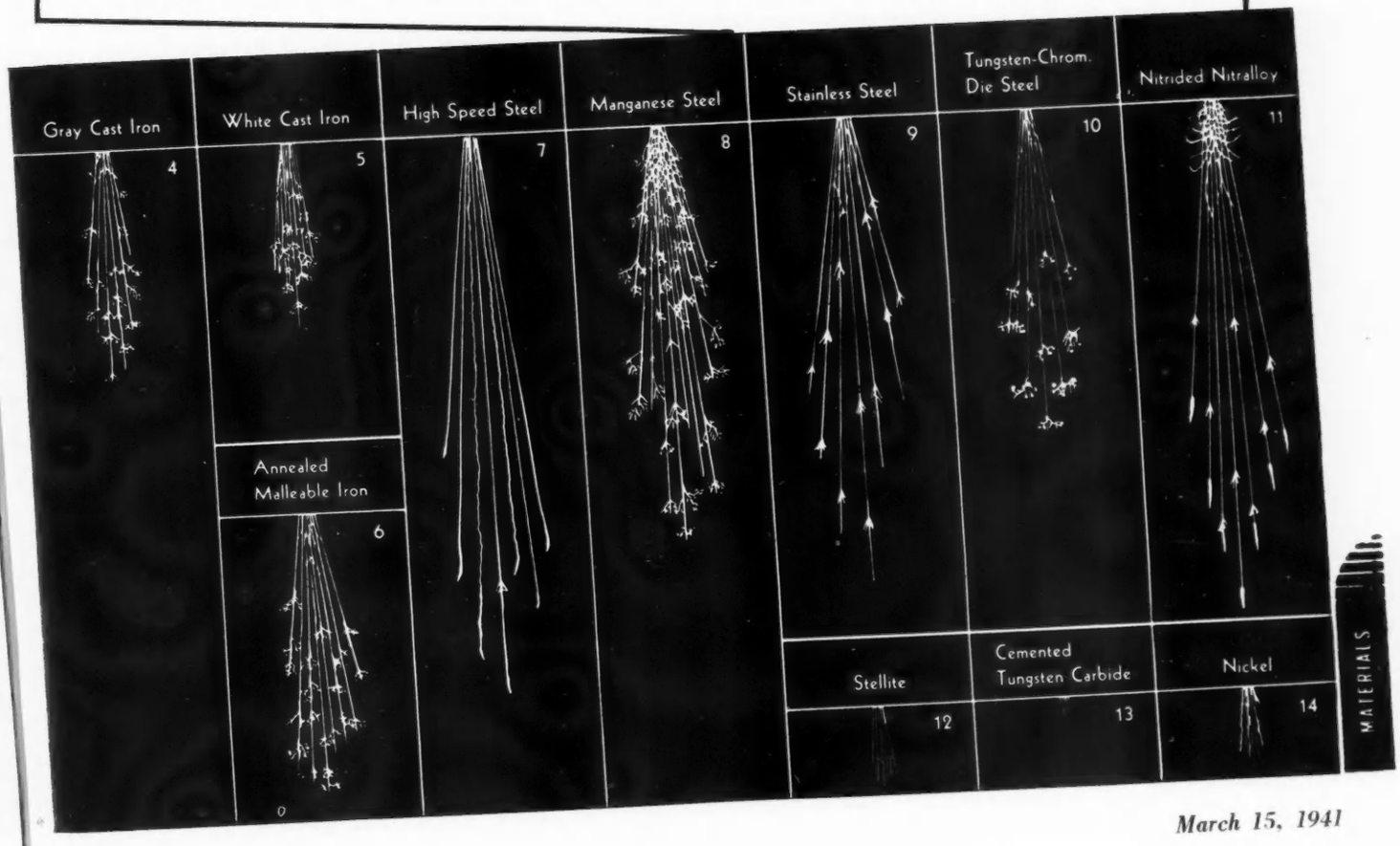
ACHESON COLLOIDS CORP., Port Huron, Mich., has developed a method of lubricating bearings operating at high temperatures by coating their surfaces with graphite through the vaporization of the oil at the particular temperature of operation. The lubricant consists of a suitable volatile vehicle with Dag colloidal graphite dispersed in it. The colloidal graphite penetrates wherever the volatile vehicle does and thus coats the metal bearing surface even though a small amount of lubricant is used. Since the graphite does not flocculate, it is said to remain suspended in the vehicle indefinitely.

The chart and table below, showing spark characteristics of commonly used metals, are from a folder "Sparks" recently issued by the Norton Co.

CHARACTERISTICS OF SPARKS GENERATED BY THE GRINDING OF METALS

Metal	Volume of Stream	Length of Stream, Inches	Color of Stream Close to Wheel	Color of Streaks Near End of Stream	Quantity of Spurts	Nature of Spurts
1. Wrought iron	Large	65	Straw	White	Very few	Forked
2. Machine steel	Large	70	White	White	Few	Forked
3. Carbon tool steel	Moderately large	55	White	White	Very many	Fine, repeating
4. Gray cast iron	Small	25	Red	Straw	Many	Fine, repeating
5. White cast iron	Very small	20	Red	Straw	Few	Fine, repeating
6. Annealed malleable iron	Moderate	30	Red	Straw	Many	Fine, repeating
7. High speed steel	Small	60	Red	Straw	Extremely few	Forked
8. Manganese steel	Moderately large	45	White	White	Many	Fine, repeating
9. Stainless steel	Moderate	50	Straw	White	Moderate	Forked
10. Tungsten-chromium die steel	Small	35	Red	Straw*	Many	Fine, repeating*
11. Nitrided Nitralloy	Large (curved)	55	White	White	Moderate	Forked
12. Stellite	Very small	10	Orange	Orange	None	
13. Cemented tungsten carbide	Extremely small	2	Light Orange	Light Orange	None	
14. Nickel	Very small **	10	Orange	Orange	None	
15. Copper, brass, aluminum	None				None	

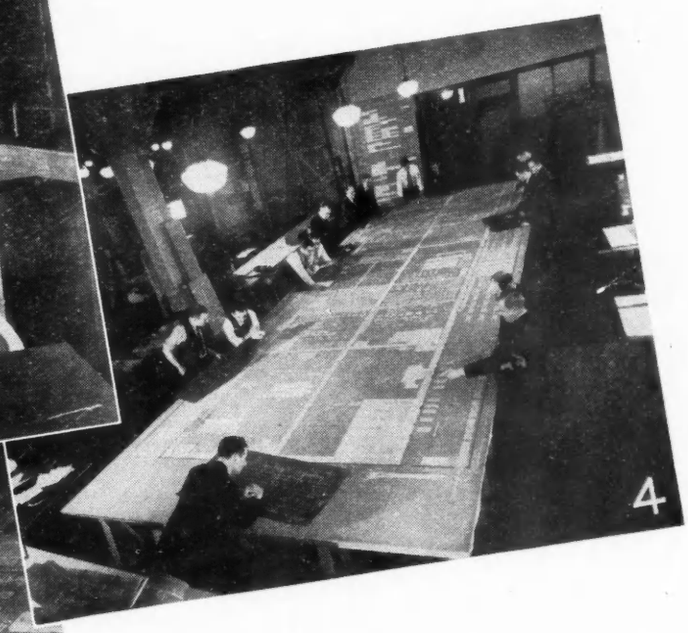
† Figures obtained with 12 in. wheel on bench stand and are relative only. Actual length in each instance will vary with grinding wheel, pressure, etc.
* Blue-white spurts. ** Some wavy streaks.

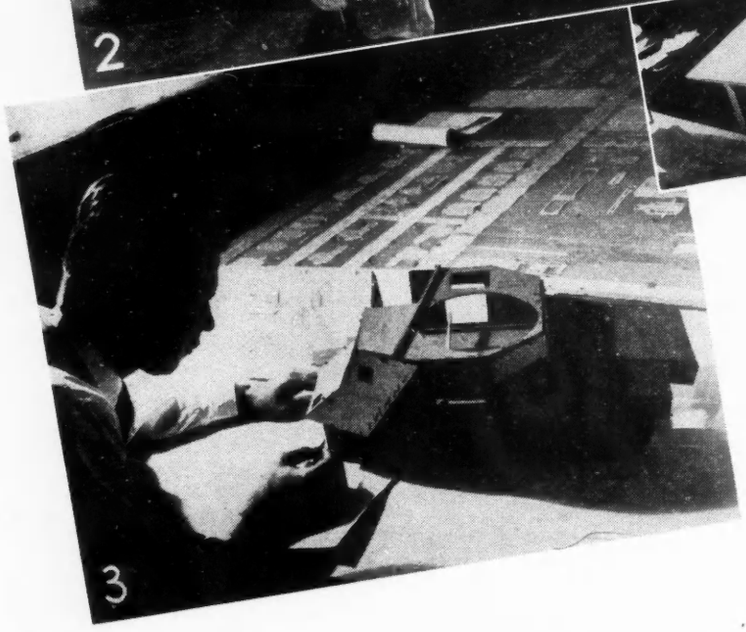


Tanks by Chrysler

THE FIRST units of heavy machinery have been installed in the Chrysler Tank Arsenal. They are the fore-runners of the 1000 machines and 8000 other tools and fixtures with which the arsenal is to be equipped. There is now substantial expectation that production of five 25-ton tanks per day, on a one-shift basis, will begin by mid-September.

Each of the Chrysler-built tanks will be equipped with a 75-mm. cannon, a 37-mm. cannon, a 30-mm. anti-aircraft gun and several machine guns, and will be manned by a crew of seven. Rough dimensions of the tank are 9 ft. by 9 ft. by 20 ft. A 400-hp. radial engine will be used. The engine, armor plate and cannon will be supplied by the Government. Everything else, including gun mountings will be manufactured or purchased by the Chrysler Corporation.





1. ***Intricate and heavy castings for the 25-ton tanks. The building in which these tanks will be made should be completed about April 1 with finished tanks coming off the assembly line at the rate of five a day on a one shift basis by early fall***

2. ***Engineers study castings for the large tank that Chrysler will make for the U. S. Army***

3. ***A small cardboard model of the tank is used to visualize some of the problems which will be involved in manufacturing them***

4. ***The layout of the plant in which the tanks are to be turned out shows a development 500 feet wide and 1380 feet long. On the final assembly line 66 tanks will be in the process of assembly at one time***

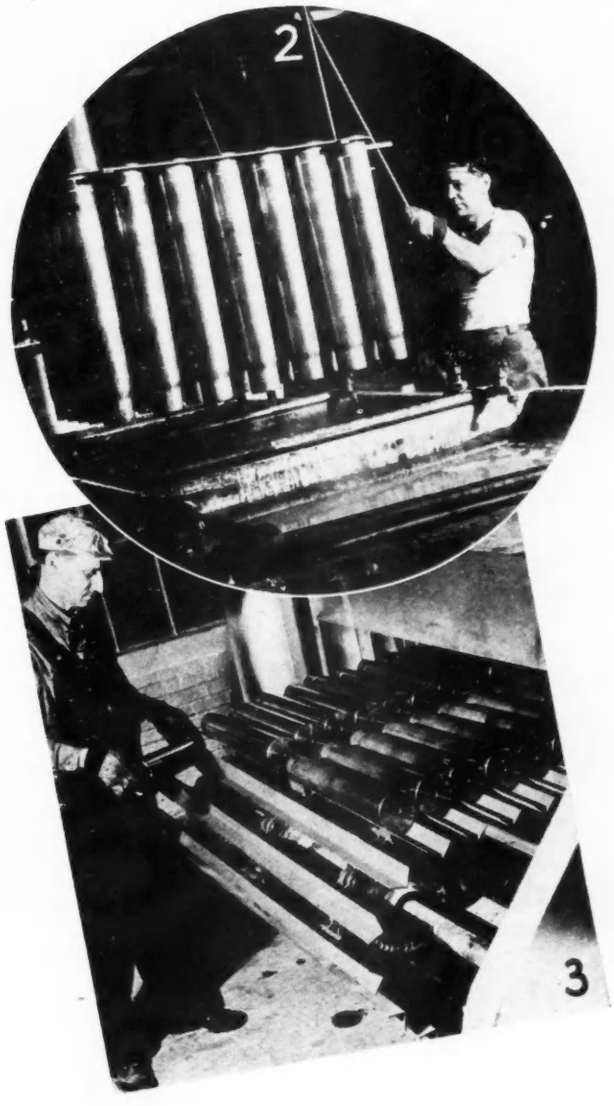
1. *Typical of the preparation and "make-ready" necessary for defense production is this photograph showing the rough-milling of a die-block to be used in the production of 105-millimeter shells.*

2. *Removing grease and other foreign substances from cartridge cases after they have been through the annealing equipment is one of a multitude of operations necessary in the production of this defense item. Mouths of the cases are annealed to assure ductility of metal before loading.*

3. *A steady flow of cartridge cases is seen emerging from a stress release annealing process. This activity is in connection with cases being produced on an educational order.*

Shells by General Motors

4. *A 75-millimeter shell being finish-turned on one of the new rigid turning lathes in the General Motors forge plant of Olds Motor Works Division at Lansing, Mich. All of the machinery installed in this newly acquired plant was purchased with the original intention of producing automobile parts, it has now been converted for the production of shells.*

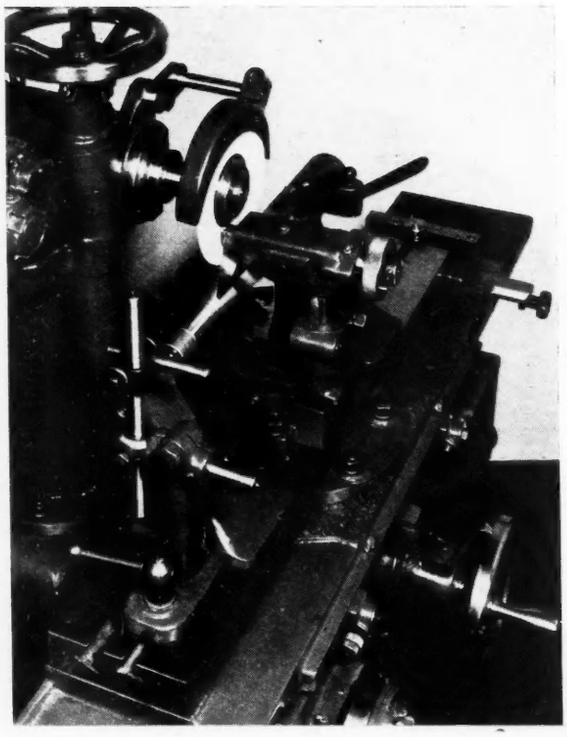


DEFENSE orders for the manufacture of shells and cartridge cases totaling approximately $14,400,000 have been placed with General Motors. Uninterrupted production of 75- and 105-mm. shells and of cartridge cases is scheduled for about May 1.

In the new forge plant of the Olds Motor Works Division both 75- and 105-mm. shells will be manufactured. Machinery for the production of automobile parts, has been converted to shell and die production.

The General Motors forge plant will make shells by the "upset" method, because of the availability of convertible equipment, and also because the process provides a close control over the quality and precision of the product, and uses a minimum of material.

A new building of General Motors Guide Lamp Division will be devoted to the production of cartridge cases. They will be manufactured through a reduction drawing process of approximately 20 operations. These operations include heading, tapering, machining and the various pickling and annealing processes to release locked-in stresses.

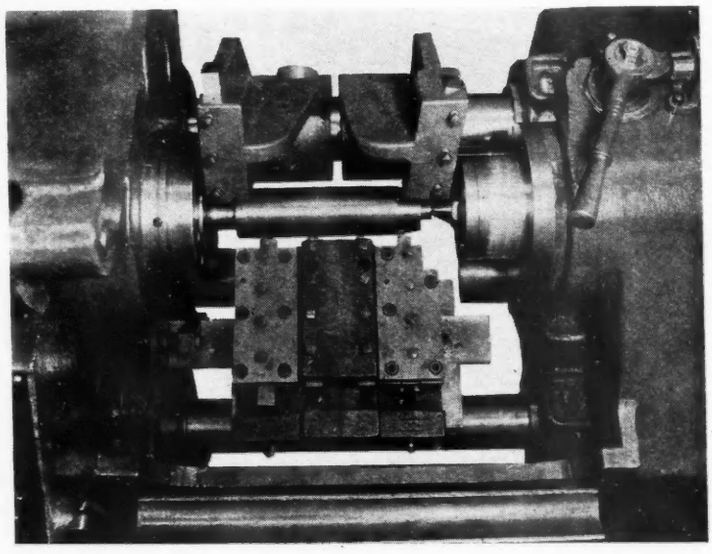


Brown & Sharpe through-feed attachment in operation.

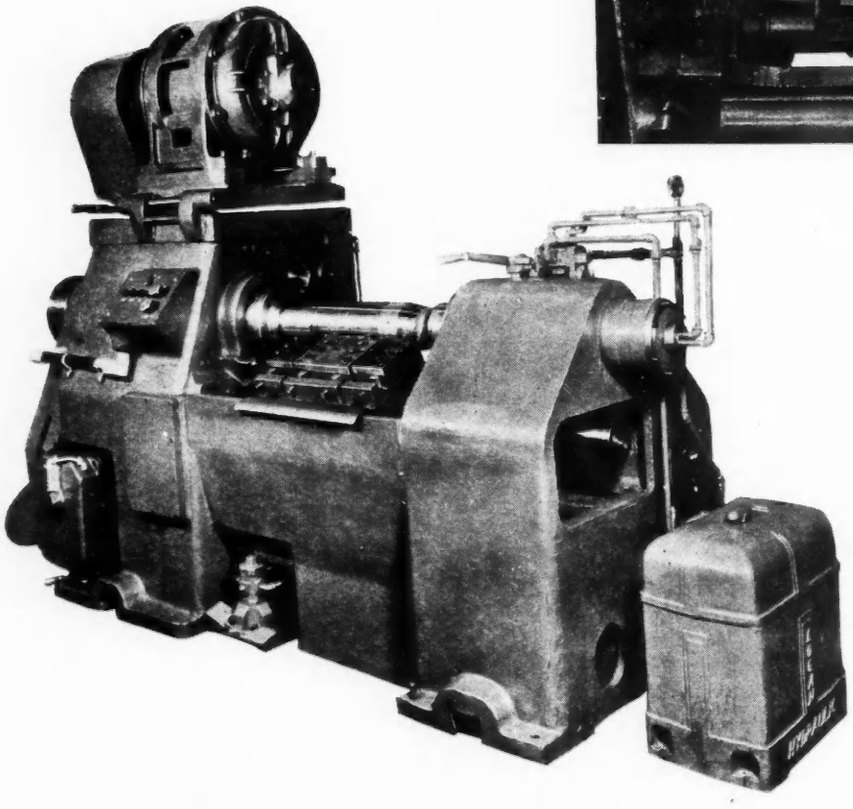
THE MACHINE tool industry, working through the Defense Committee of the National Machine Tool Builders' Association, has designed a line of special machines for the making of shells. The purpose of the project, undertaken at the suggestion of Army Ordnance officers, is to put into the hands of the War Department complete and tested designs for shell machines that can be built quickly in any well-equipped manufacturing shop whenever the need for them arises.

The design comprises a complete line of machines

MEN and M



(Right) Tooling set-up for 75 mm. (3-in.) shell to rough turn diameter and face end simultaneously. (Below) Lathe operation on 6-in. shell.



for turning, boring and facing medium-caliber shells. The machines are of two sizes—one for the 3-inch group of shell, the other for the 6-inch group. In each group there is a basic machine that is standard for all of the operations in that group. Each unit is then equipped with whatever slides, tailstock, tooling equipment and motor drive are required for a certain operation. The machines are capable of all operations except cross drilling, notching, and such operations as nosing-in, squeezing the band into the band seat, and welding the base end-plate.

There are three outstanding features about the new machines

—(1) they are of simple construction so they can be built quickly in substantial quantities; (2) they are inexpensive and can produce shells economically, and (3) they are automatic so they can be handled by unskilled operators.

To make the building of the machines as simple as possible, the design completely eliminates all large planing and boring operations and all machining operations, large and small, on the main casting, except for the drilling of a few small holes. This is accomplished by supporting the carriage for the turning tools

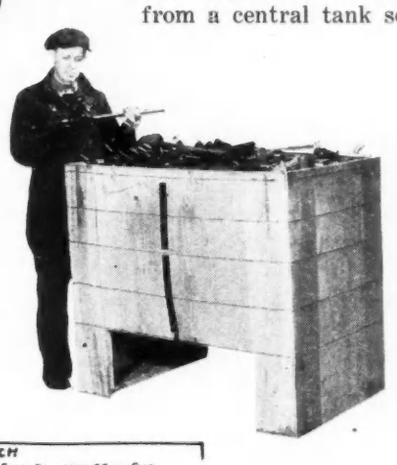
MACHINES

as well as the swinging arms for facing operations entirely on longitudinal bars instead of planed way surfaces. Moreover, these bars (there are three of them) together with the spindle, tailstock sleeve and all shafts, are carried by bushings which are cast in place in the main base of the machine.

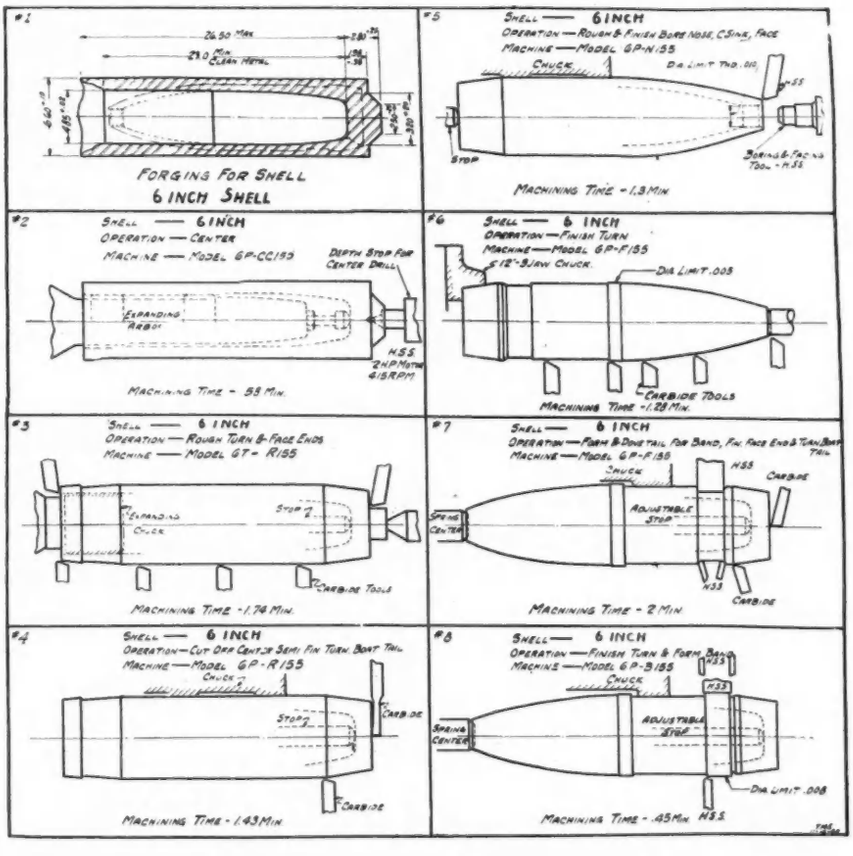
The machines are all single-speed units except in cases where 2-speed motors are used. The motors vary from 10 to 60 H.P., depending upon the particular operation to be performed.

There are two principal methods of holding the shell—(1) gripping it on the inside of the open end by means of an expanding arbor, while using the tailstock center for supporting the base end of the shell; and (2) gripping it on the outside diameter by means of a collet chuck. In either case the shell-holding mechanism is hydraulically actuated, and control is by means of foot levers, in order to leave the operator's hands free.

It is intended that one central hydraulic system, with accumulator and tank, will serve a complete line of the machines, to avoid the greater expense of a self-contained hydraulic system for each machine. Lubrication of the machine is by gravity from a trough cast in the top of the base. Coolant is to be supplied by gravity from a central tank serving several machines.



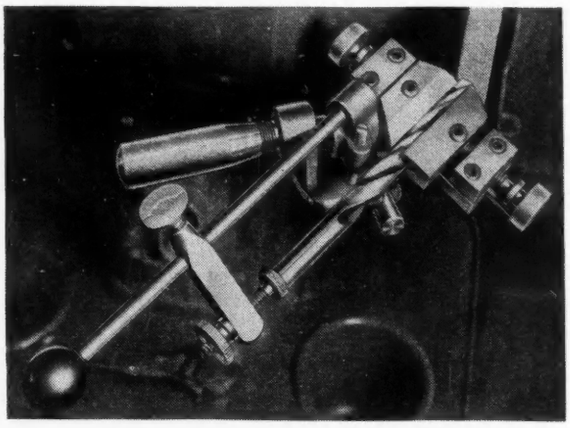
This container, designed by General Box Co. for platform truck handling, is used by an equipment maker for shipping jacks to its customers. This box holds about 2000 pounds.

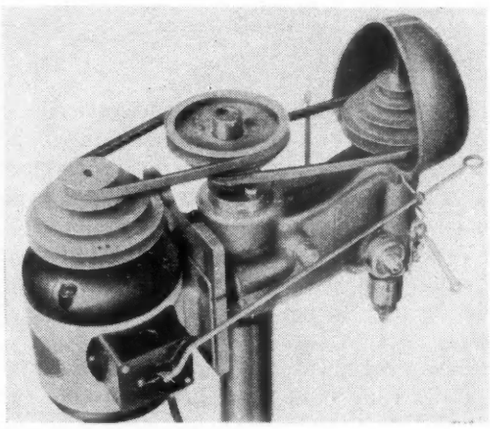


Typical operation sequence on a six-inch shell.

BROWN & SHARPE MFG. CO. of Providence, R. I., has added to its line of grinding equipment two new formed cutter sharpening attachments, one of the in-feed type and the other of the through-feed type. The in-feed attachment is designed for sharpening formed cutters 2 to 6½ in. in diameter with straight teeth of not more than 1½ in. in width. Essentially, it consists of an adjustable tooth rest assembly and a body for supporting the cutter, mounted on a base plate which is tongued for alignment and bolted to the top of the tool rest regularly furnished with the machine.

The through-feed attachment, which is shown here, permits a straight cut across the entire tooth face and can be used for sharpening formed cutters up to 6 in. in diameter with straight teeth. This attachment consists of a rigid,





Right — Delta multi - speed drill press attachment. Described on page 354.

Left — Delta drill grinding attachment.

adjustable tool rest assembly mounted at the top of a sturdy column which is adjustable vertically. A rack and pinion provide positive adjustment and the rack serves as a key to maintain angular alignment. The supporting bracket, which carries the column, is adjustable transversely along dovetail ways in a solid base, which in turn is tongued.

REFLECTING its remarkable speeding up in response to national defense requirements and supporting a prediction made in AUTOMOTIVE INDUSTRIES for February 15, a report submitted to the House Committee on Military Affairs estimated that the 1941 output of the machine tool industry will aggregate $750,000,000. This compares with World War peak production of $200,000,000, the 1929 peak of $185,000,000, the depression level, average of 1932 and 1933, of only $23,500,000, a 1939 production of $200,000,000, and a sharp rise to $450,000,000 in 1940. The report was submitted by Mason Britton, head of the OPM Tools section in compliance with a House resolution.

Four methods are used by machine tool companies to expand production. They are: more plants, more machinery, training thousands of new men and subcontracting.

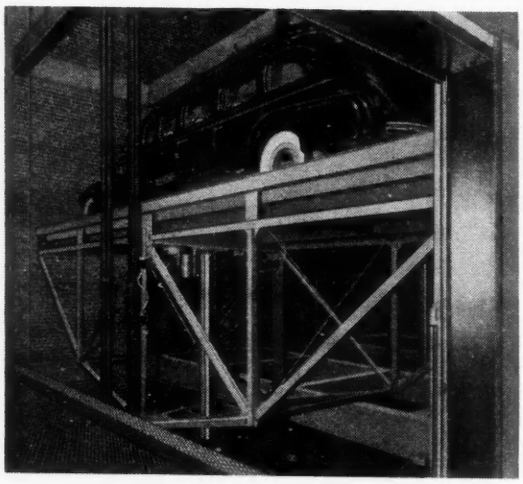
Difficulty is being experienced in finding satisfactory subcontractors for machine tool work, but every possibility is being carefully studied, shops are being classified by the Planning Board and recommendations made to the machine tool builders. It was stated that there are now 38 firms outside the machine tool industry manufacturing complete machine tools.

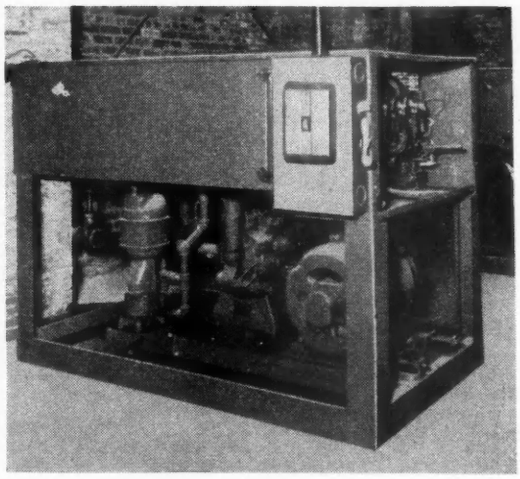
AMONG the most striking contributions to an efficient practice of shipping and storing of parts and materials is found in a newly developed container, placed on the market in recent months by the General Box Co., Chicago. As illustrated on the preceding page, this shipping container is of wood construction stoutly bound, said to handle loads which are usually reserved for steel containers, at but a fraction of the cost.

The containers can be made in any range of sizes and in any of a number of styles. For example, the box illustrated here is designed for platform truck handling.

Large boxes have been made for one of the largest motor car manufacturers to facilitate the shipping of various parts by freight to principal assembly plants. Side-to-side, two containers fit in the width of a standard railroad freight car. Apart from the moderate cost of the container, the utility of this arrangement is apparent in several ways: ease of packing at the source, ease of loading into cars, and ease of unloading at the other end.

(*Turn to page* 354, *please*)





(Left) Elevators in New York's Airlines Terminal are designed to support a fully loaded air lines bus with ample strength in reserve.

(Right) A power unit for operating a Rotary Oildraulic Elevator. (See description on page 354.)

NEWS OF THE INDUSTRY

Army Bombers to Be Built at Four Inland Plants

Automobile Industry Getting Ready to Supply Airframe Parts; Chrysler Tanks to Be Powered by Wright Engines

Contracts totaling $24,694,284 have been let by the War Dept. for the construction of three final assembly plants in the Mid-West where U. S. Army bombers, for which the automobile industry will furnish the airframe subassemblies, will be produced. A $10,476,400 contract has been awarded for a plant at Tulsa, Okla., to be operated by Douglas Aircraft Corp. for assembling 50 Consolidated B-24 four-engined bombers monthly. A similar plant costing $10,511,400 will be built at Fort Worth, Texas, to be operated by Consolidated Aircraft Corp., where another 50 B-24 bombers will be produced each month. Airframe parts and lading landing gear for both these plants will be manufactured by the Ford Motor Co. at its new plant to be built near Ypsilanti, Mich.

Preliminary construction surveys are under way for the $11,00,000 Ford airframe assembly plant, about 15 miles west of the Rouge plant. It will comprise two sections in T-formation, one 800 by 300 ft. and the other 1200 by 400 ft. Provision has been made to extend the plant to house a mile-and-a-quarter long assembly line for final assembly of the complete plans if the government should decide to alter or augment the present plans calling for assembly plants at Tulsa and Fort Worth.

Kansas City Plant

Another contract for $3,706,484 has been let for building a plant at Kansas City to be operated by North American Aviation Corp. One hundred B-25 North American two-engined bombers will be produced there monthly from parts furnished by General Motors, chiefly by the Fisher Body Div. General Motors estimates the cost of these subassemblies at $62,400,000 for a year, comprising an output of 1200 planes. Much of the stamping work is expected to be carried out at Fisher Body plants at Cleveland and Detroit, with the Memphis plant also figuring prominently in the operations.

A fourth assembly plant is to be built at Omaha for operation by the Glenn L. Martin Co. to turn out 100 Martin B-26 bombers per month. Martin already has orders for $134,863,000 of these planes. Chrysler Corp. and Goodyear Tire & Rubber Co. will furnish the airframe parts and landing gear for the Omaha plant, which will have 1,250,000 sq. ft. of floor space.

Graham-Paige Factory

An advance staff of Chrysler technical men is laying out the section of the Graham-Paige Motors Corp., leased by Chrysler for the production of subassemblies for the Martin B-26 bomber. Chrysler will produce the two main fuselage sections. Chrysler engineers also are working on the conversion of two foreign makes of anti-aircraft guns for U. S. manufacture as well as experimenting on an in-line liquid-cooled aircraft engine for military use. One and two-cylinder test models have been built on the latter.

Goodyear Aircraft Corp., affiliate of Goodyear Tire & Rubber Co., is seeking a 147-acre plot adjacent to the Akron Airport for construction of a new building to contain 500,000 sq. ft.

(*Turn to page 353, please*)

Conveyor System at New Bell Aircraft Factory

Similar to the conveyor system utilized in the mass production of automobiles is the movable floor that will be a feature of the new Bell Aircraft Corp. plant now nearing completion at Niagara Falls, N. Y. Assembled parts will move onto the conveyor and a completed airplane will be wheeled off at the end after final assembly operations have been completed at 14 stations.

Costing more than $1,250,000, the new plant is 600 by 400 ft. It is divided into three principal parts—the center bay, along which production lines will move mechanically to a hangar; the north bay, where the wing department will be located, and the service and receiving rooms to which will come all the parts manufactured at Bell's Buffalo plant; and the south wing to house the fuselage assembly.

Lewis E. Saunders

Lewis E. Saunders, age 67, since 1937 vice-president of the Norton Co., Worcester, Mass., died Feb. 20. A pioneer in the development of electric furnace abrasives, he became associated with Norton Co. in 1903, and since then has served as chemical engineer, metallurgist and superintendent of abrasive plants and research laboratories.

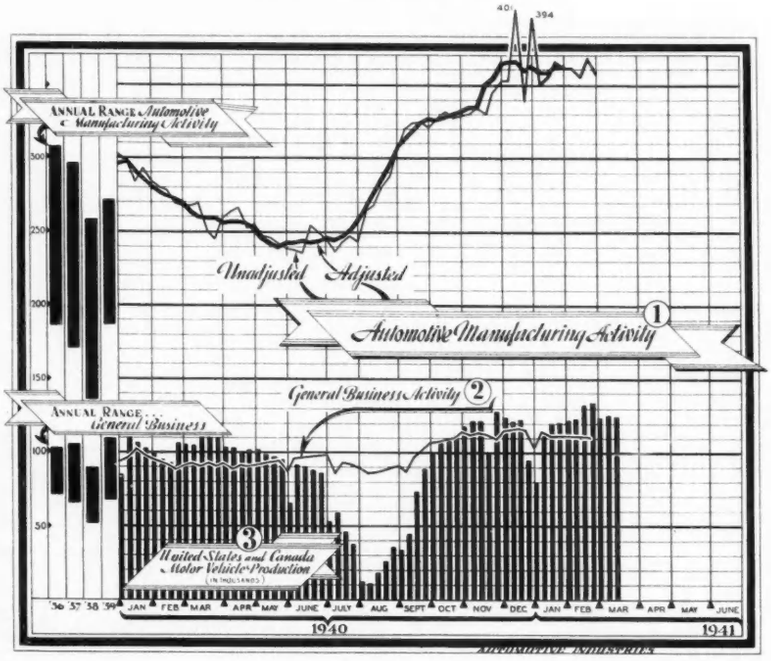
International

Rough-Riding Axis Party

Military motorized units of this type are used by Germany to transport troops—last summer through the Low Countries, later at proving grounds near Berlin, now over the rough terrain of the Balkans. A Nazi-Italian party is shown on a ride with Count Bonacossa, president of the Automobile Club of Italy, in the rear seat.

BUSINESS IN BRIEF

[Our own view of automotive production and sales; authoritative interpretation of general conditions]



Weekly indexes of automotive general business charted

Dealer Stocks Mount Despite Record Sales

PRODUCTION for the first quarter of 1941 is expected to fall only a few thousand units short of the record for the period, set in 1929, when 1,546,319 motor cars and trucks were turned out in the first three months of the year. The 1941 first quarter is expected to exceed that for 1940, when output of 1,311,949 vehicles made it the second highest in the industry's history by more than 17 per cent.

Following record January and February output, early March saw no letup in the high production pace, with approximately 250,000 units assembled in the U. S. and Canada for the first half of the month. With this rate continuing for the rest of March, production may pass the 1937 mark of 519,022 units, but still will fall far short of the March record of 626,076 units established in 1929. With 21 working days, one more than February, March is certain to go over the 500,000 mark.

Although sales were at an unusually high level as dealers warned buyers that higher prices were in prospect due to the likelihood of added taxes and higher production costs, inventories continued to mount. U. S. dealer stocks were estimated at 434,046 units as of Feb. 1, the highest total in years. Dealer inventories increased 29 per cent during January despite the fact that consumer sales were the highest in the month's history.

Material shortages are not critical although the manufacturers are experimenting with substitutes for chrome trim and grille work, as zinc is difficult to obtain. Some companies that use aluminum pistons are trying out other metals due to the Government priority on aluminum for defense industries.

[1] 1923 average = 100; [2] Prepared by Administrative and Research Corp. of New York. 1926 = 100; [3] Estimated at the Detroit office of AUTOMOTIVE INDUSTRIES.

Production was estimated at 125,500 units for the week ending March 8, the biggest week to date in 1941. General Motors assembled 54,800 vehicles, while Chrysler turned out 28,100 and Ford manufactured 26,100. Studebaker kept its place at the head of the independents, followed by Nash, Hudson, Packard and Willys. Production was expected to slacken slightly for the week ending March 15. Army truck production, especially at General Motors Truck, Chevrolet and Dodge, was boosting output by several thousand units weekly.

January production of 524,126 units, according to the Dept. of Commerce, was the biggest for a single month since May 1937 and 17 per cent greater than the previous January. The Automobile Manufacturers Association estimated February output in U. S. plants only at 475,500 units, 18 per cent higher than February 1940, but more than 25,000 less than January, which had two more working days.

Retail sales mounted to record levels during February despite the short month. GM dealers in the U.S. sold 187,252 vehicles to consumers in February, the highest total for a single month since April, 1937, and surpassing the 186,016 units retailed last October, which was the highest mark for 1940. Two of the largest volume producers in the industry both went over the 100,000 mark in February retail deliveries. Nash delivered 9431 cars at retail during the month for the best February in its history and 156 per cent higher than the same month of 1940. Retail sales of Chrysler cars during the week ending March 1 were the biggest for a single week, with one exception, in the division's history.

New passenger car registrations in 83 principal cities for the first 25 days of February showed a 32 per cent gain over the same period of 1940.

Defense Is Major Theme For ASTE Show in Detroit

Display of Tools and Machines March 25-29 to Be Largest in History; Important Technical Sessions Scheduled

That the Machine & Tool Progress Exhibition of the American Society of Tool Engineers on March 25 to 29 in Detroit's Convention Hall will be the largest in its history is certain since at least 250 exhibitors have reserved space far exceeding previous records. Following a trip through the exhibition on the afternoon of March 24, many of the country's prominent executives, engineers, educators, Army and Navy officers engaged in national defense preparations will attend a "preview" dinner.

Major-General C. M. Wesson, chief of Army ordnance, is coming from Washington to address the dinner gathering on the subject, "The Job Facing Industry in Arming This Nation." L. C. Hill, manufacturing manager, Murray Corp., will act in his usual capacity as toastmaster.

In keeping with the urgency of the national defense program, the keynote of the ASTE exhibition and its technical meetings is that of "Education for Defense." This theme is carried out not only in the tenor of the technical papers but in the character of the displays. For example, in addition to the formal exhibits which constitute the show itself, the ASTE will have at least three and perhaps four special displays intended to disclose the details of some major projects for the benefit of prospective sub-contractors. Barring last minute changes in this plan, there is to be an exhibit of one of the new Pratt & Whitney aircraft engines, supplemented by a panel showing the parts of the same engine completely dis-assembled. If possible the plan also contemplates a similar display of one of the tanks built by Chrysler Corp.

Variable Pitch Propeller Display

In addition, Hamilton is to show its electrically-controlled variable pitch propeller as an assembly and completely dis-assembled. A proposed feature is a display of fighting aircraft components.

Generally speaking, technical meetings are scheduled for three evenings, March 25 to 27, with the annual banquet on the evening of March 28. The exhibition will remain open from 10 A. M. to 10 P. M. each day except Friday and Saturday. On the latter two days it will close at 6 P. M.

Aircraft production will hold the stage on Tuesday evening with a paper, "Aircraft Engine Design and Production," by C. W. Van Ranst, chief aircraft engineer, Ford Motor Co., and a paper, "Tooling for Fuselage Production," by Louis Biehler, asst. chief tool designer, Vultee Aircraft, Inc. Discussion of these papers will be lead by C. C. Carlton, acting director, Automotive Committee for Air Defense.

The Wednesday session will center on naval ordnance production with two important technical papers on the schedule. Joseph A. Davies, chief planner and estimator, Naval Gun Factory, Washington, D. C., will speak on "Planning for Production of Naval Ordnance Units," while "Problems of Production of Naval Ordnance Units" will be discussed by E. M. Sims, president, Metal Forming Corp., Elkhart, Ind.

Education Night

Education night, expressing the keynote of the meeting, encompasses three important topics for discussion. "Industry's Need in Skilled Help" is the subject of a talk by P. W. Brown, asst. works manager, Wright Aeronautical Corp. Carl A. Gray, president, The Grenby Mfg. Co., will describe, "How Connecticut Solved the Industrial Training Problem," while J. R. Weaver, Louisville Ordnance Div., is to discuss the work of the ASTE in the field of industrial training, and will lead the discussion from the floor.

Final event is the annual banquet on Friday evening, at which the principal speaker will be L. R. Pennington, administrative assistant to J. Edgar Hoover, of the FBI. He is scheduled to speak on "How to Prevent Sabotage to our National Defense Program." Banquet chairman will be A. H. d'Arcambal, president of the ASTE.

NACA Erecting Engine Laboratory at Cleveland

Construction work is under way on the new airplane engine research laboratory being built near the Cleveland municipal airport by the National Advisory Committee for Aeronautics. This laboratory, costing $8,400,000, will consist of an engine research wind tunnel, an engine research laboratory, an engine propeller test house, a hangar, service building, and administration building.

The NACA now has two major research stations, one at Langley Field, Va., and the other at Moffett Field, Cal.

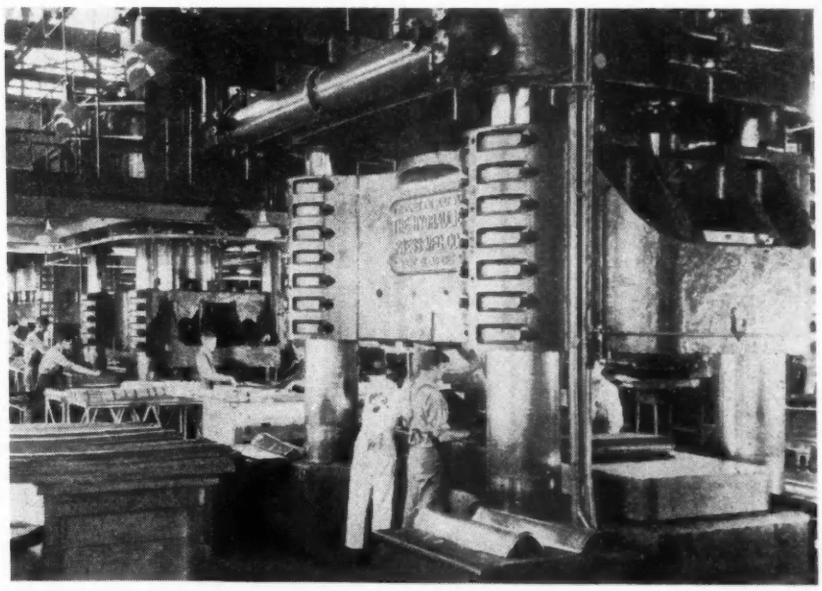
CALENDAR

Conventions and Meetings

American Chemical Society, St. Louis, Apr. 7-11
Chamber of Commerce of the U.S.A., Annual Meeting, Washington, D.C., Apr. 29-May 1
Western Metal Exposition and Congress, Los Angeles .....May 19-23
American Battery Manufacturers Assoc., Detroit .....May 22-23
Society of Automotive Engineers, Summer Meeting, White Sulphur Springs, W. Va. .....June 1-6
American Society for Testing Materials, Annual Meeting, Chicago....June 23-27
Society of Automotive Engineers, National Tractor Meeting, Milwaukee, Sept. 25-26
Society of Automotive Engineers, Aircraft Production Meeting, Los Angeles .....Oct. 30-Nov. 1

Shows

Machine & Tool Progress Exhibition, Detroit .....Mar. 24-29
Automotive Trade & Accessories Show, Boston .....May 1
Automobile Accessories Association Show, Chicago .....Aug. 4-7



Acme

Pressure For Defense

Aviation's largest line of hydraulic presses is shown turning out airplane parts in the Douglas aircraft plant at Santa Monica. Hardened rubber mats in the steel walls of the presses cut and form in one operation aluminum alloy sheets into parts of all sizes and shapes.

No Labor Dispute in Ford Plants Is Company Claim

UAW-CIO Refuses to Recognize Michigan Mediation Board and 30-Day "Cooling Off" Period; Strikes Are Spreading

Official cognizance of the dispute between the UAW-CIO and the Ford Motor Co. was taken when the union filed notice of intent to strike at three plants around Detroit and Gov. Murray D. Van Wagoner appointed a special three-man mediation commission in an attempt to settle the controversy. The UAW-CIO filed the strike notice covering the Ford Rouge, Highland Park and Lincoln plants on Feb. 27 with the Michigan Labor Mediation Board.

However, in a letter to Gov. VanWagoner, Roy W. Thomas, president of the UAW-CIO, said the union refused to recognize the legality of either the three-man mediation commission or the 30-day "cooling-off" period invoked by the Labor Mediation Board when it was informed by the National Defense Advisory Commission that Ford has $154,000,000 in defense orders on its books. The usual five-day strike notice expired March 4, while the 30-day notice, invoked in disputes deemed "in the public interest," will expire March 29.

Answering Gov. Van Wagoner's letter to Edsel Ford informing him of the appointment of the special mediation commission, Harry Bennett, Ford personnel chief, wrote, "I wish to inform you that no labor dispute exists between this company and its employees, despite attempts of certain groups of labor agitators to create this impression. This is the same group which introduced the sit-down strike to America and the reign of terror which followed. . . . I feel that neither the State nor the government should be called upon to settle or mediate a "cooked-up" dispute. . . . There being no dispute to discuss and no legitimate reason for Ford workers to strike, I see no reason for a conference in that regard, although, if you desire, I shall be glad to visit with the commission you have appointed."

The NLRB in Washington said that it had "under consideration" petitions by the UAW-CIO for elections at the Rouge, Highland Park and Lincoln plants. Rep. George D. O'Brien, of Michigan, called upon Dr. Harry A. Millis, NLRB chairman, to hold an election at once in order not to jeopardize the defense program. The AFL kept in the picture when President William Green said his union was ready for an election in the Lincoln plant at any time. He did not mention the Rouge and Highland Park plants, the former employing more than 87,000 men.

Installation of machinery at the new Chrysler Tank Arsenal was temporarily delayed for a week due to a 27-year-old jurisdictional dispute between two AFL unions, the International Association of Machinists and the Inter-

(*Turn to page* 353, *please*)

Auto Radio Output Has Rapid Growth

Steady growth in the branch of the United States radio industry devoted to the manufacture of automobile radio receiving sets is shown in statistics compiled by the Bureau of the Census from returns of the biennial Census of Manufacturers.

The number and value of automobile sets at the factory, by census years since 1931, are given in the following table:

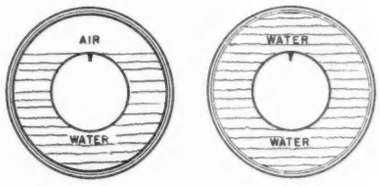
Year	Number	Value
1931	96,145	$ 3,076,191
1933	700,018	13,597,863
1935	1,191,758	25,556,018
1937	1,890,841	38,679,145
1939	1,587,227	27,715,879

Ford Blitz Buggies in Action

After the first of the 1500 midget reconnaissance cars for the Army began rolling off the line at the Rouge plant of the Ford Motor Co., test drivers bounced some over rough ground at nearly 60 m.p.h. They will climb 80 per cent grades.

Goodyear Develops 100% Water - Filled Farm Tire

Development of the Hydro-Tire, a new principle that makes possible 100 per cent inflation of tires with water for use on farm tractors, is nearing completion at the Akron laboratories of the Goodyear Tire & Rubber Co. after years of research and field tests. Filling of the tire, which has no inner tube, is accomplished by a special method of bleeding the air from it. This development also permits 100 per cent inflation of hydro-pneumatic farm tires already in use, but they must be equipped with inner tubes.



Hydro-Pneumatic Tire With Inner Tube 65% Water Filled

Hydro-Tire No Inner Tube 100% Water Filled

When pneumatic farm tires were first introduced, they were inflated 100 per cent with air. Then when the advantages of partially filled tires with water became apparent, tire companies developed the hydro-pneumatic principle, now in common use, whereby water is injected to the so-called "valve level," which is approximately 65 per cent of the tire volume. This is the maximum practical amount of water that can be added without some means of bleeding air from the tire.

As a result of the Hydro-Tire development, the weight of the tires can be increased from 30 to 50 per cent, depending upon the size, which results in greater traction and reduced bounce on rough ground. A 11-38 tire with valve level filling weighs 401 lbs., and with 100 per cent filling the weight is 525 lbs., or 31 per cent increase. With a 8-32 tire, the weight is increased from 148 to 225 lbs., or. 52 per cent gain. The calcium chloride solution used in tires of this type prevents freezing down to 20 degrees below zero.

Chrysler Earnings

Net profits of the Chrysler Corp. and its wholly-owned subsidiaries in this country amounted to $37,802,279 in 1940. Sales totaled $744,561,238, including the sale of 1,044,290 vehicles.

Raise Tennessee Weight

Increasing the maximum allowable weight of trucks from 24,000 to 30,000 lbs. was the main provision in a bill passed by the Tennessee legislature last month. The bill also prohibited more than 16,000 lbs. being carried over one axle.

MEN . . . . . .

Seth Klein, former sales manager of the Detroit Gear & Machine Division of the Borg-Warner Corp. and well-known as starter of the Memorial Day race at the Indianapolis Speedway for the past 22 years, returns to Indianapolis as assistant to Vice-President Dingley of the Marmon-Herrington Co.

W. D. Van Dyke, of Air Associates, Bendix, N. J., has been named general manager of its newly-formed radio division.

John W. Mock has been advanced to sales manager of the Liquid Fuel Appliance Division of the Turner Brass Works, Sycamore, Ill.

Col. J. L. Cochran, vice-president in charge of sales for the Seiberling Rubber Co., Akron, has been elected to the company's board of directors.

Harlow D. Burnside, former resident manager of the Fisher Body Division of General Motors in Buffalo, has been transferred to the Fisher plant at Janesville, Wis., as manager.

R. M. Mills, formerly manager of the Dining Car Division of the J. G. Brill Co., Philadelphia, has been appointed director of personnel for the company.

Clarence W. Avery, president and board chairman of Murray Corp. of America, has been appointed by the Office of Production Management as co-ordinator to stimulate subcontracting of national defense orders in the Detroit district.

E. J. McPhee has been appointed general superintendent of the Dodge Truck Division of Chrysler Corp., succeeding **John Porter,** who has joined the Federal Motor Truck Co. as works manager.

H. Herbert Hughes, formerly chief economist of the Mineral Production and Economic Division of the Bureau of Mines, has joined the Washington staff of the Automobile Manufacturers Association to take charge of its materials section.

P. L. Griffiths, formerly treasurer of the Overseas Division of General Motors, has been elected vice-president of the Ethyl Gasoline Corp. in charge of the financial department.

Clinton E. Swift is now in charge of the development, production and distribution of Ampco-Trode for the Weldrod Division of Ampco Metal, Inc., Milwaukee.

Lincoln Electric Co., Cleveland, announces the appointment of **Stewart J. Hieronymus** as sales engineer with its San Francisco office.

Dr. Tracy C. Jarrett, formerly assistant metallurgist with the American Optical Co., has been appointed chief metallurgist for Koppers Co., American Hammered Piston Ring Division, at Baltimore.

J. Allen Cortright is now sales manager of the Kerrick Division of the Clayton Mfg. Co., Alhambra, Cal.

Foster P. Whitworth has been named works manager of the Bullard Co., Bridgeport, Conn.

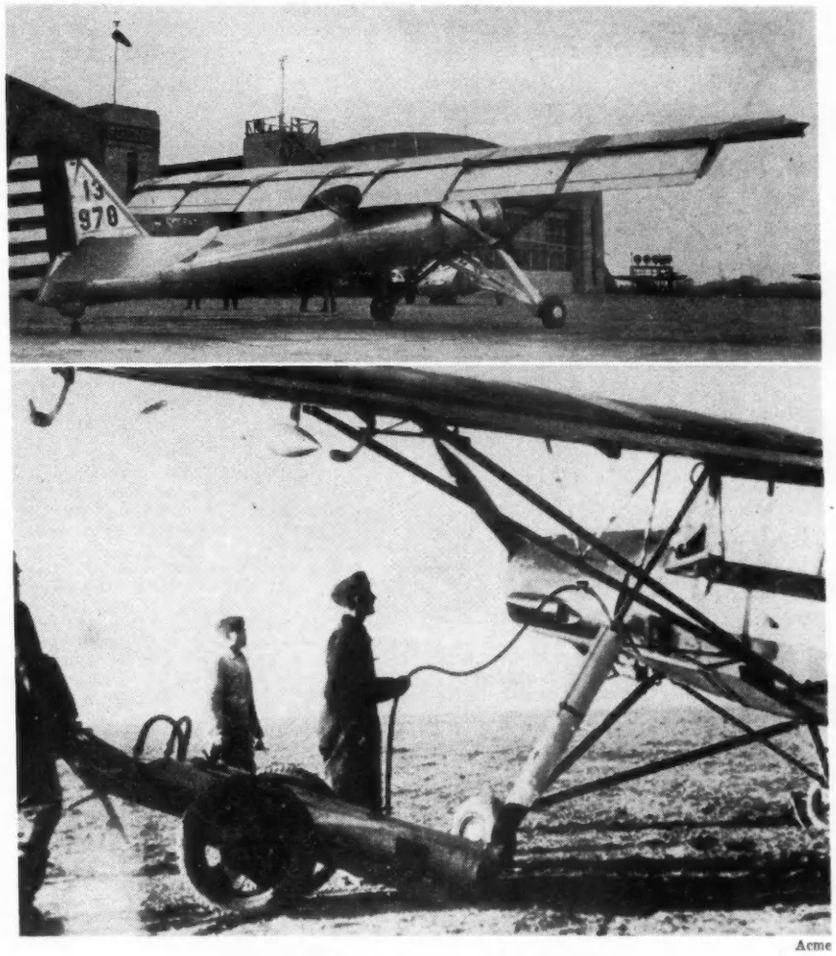
S. J. McDowell has been placed in charge of production as a member of the engineering staff of the American Lava Corp., Chattanooga, Tenn.

Gordon A. Webb has been named Detroit and Michigan distributor of G-S-R products used in the heat treatment and finishing of metals.

R. C. Anderson, formerly Pittsburgh district manager of the Norton Co., Worcester, Mass., has been transferred to the staff of the general sales manager at the home office. He is succeeded at Pittsburgh by **C. B. Price.**

Howard P. DeVilbiss and **Roy A. Guyer** have been elected vice-presidents of DeVilbiss Co., Toledo. Allen D. Gutchess, president; Frank A. Bailey, vice-president and general manager; and Walter W. Conklin, secretary and treasurer, were re-elected at the annual meeting.

John Morrel, prominent Chicago insurance man, has been made vice-president and director of the Kropp Forge Co. at Cicero.



Acme

"Wonder Planes" in Embryo

Airplanes with low speeds also are useful for military purposes, especially at small fields, in courier service, or replacing artillery observation balloons. Army pilots call Uncle Sam's version (Top) the "Jeep." Germans have the Fieseler Stork (Lower) which they claim can stand still in the air or fly backwards. Slots at leading edge and flaps at trailing edge of the wing provide braking control.

Curtiss Will Build Large Propeller Plant

America's largest individual aircraft propeller manufacturing plant for speeding up the mass production of Curtiss electric propellers to the Army and Navy will be erected by the Curtiss-Wright Corp. near Pittsbugh, Pa. The new factory will have 415,000 sq-ft. of floor area, which will expand the total production area of the Curtiss company to 1,415,000 sq. ft.

Ground-breaking for the new plant is scheduled for this month, with production to start by late summer.

George W. Fleming

George W. Fleming, president of the George W. Fleming Co., Plantsville, Conn., died Feb. 9. While vice-president and sales manager of Stevens-Walden, Inc., he resigned in 1932 because of illness. Later he organized the Fleming Co. for manufacture of motor-driven pumps.

ADVERTISING

J. R. Ackerman, formerly assistant director of truck merchandising has been appointed director of merchandising and advertising for the Dodge Division of Chrysler.

McKee Thompson has been transferred from the Los Angeles office of McCann-Erickson, Inc., to the Detroit office as account executive on the Ford account.

Frank J. Mullen, recently associated with the late T. F. MacManus on advertising promotion for the new Americar of Willys-Overland Motors, Inc., has joined the Detroit agency of Holden, Graham & Clark.

Steve Richards, former manager of the Detroit bureau for United Press, has joined the publicity staff of Arthur Kudner, Inc., in Detroit and will work on the Fisher Body account.

Harold Merillat, president; **John Toigo** and **George Piper,** vice presidents, have left the U. S. Advertising Corp. in Toledo to join the H. H. Kastor & Sons Advertising Co., Chicago.

Darrell Roberts, formerly advertising manager of Willys-Overland Motors, Inc., has joined the Detroit sales staff of Codray & Gross, printers.

Business in Brief

***Written by the Guaranty Trust Co., New York, Exclusively for* AUTOMOTIVE INDUSTRIES**

Generally intensified business activity has been well sustained recently. The seasonally adjusted index of The New York *Times* for the week ended Feb. 22 rose to 121.5 per cent of the estimated normal, as against 121.1 for the preceding week and 101.7 a year ago. The unadjusted index of *The Journal of Commerce* for the same period declined to 115.9 per cent of the 1927-29 average from 116.6 for the week before.

Department store sales during the week ended Feb. 22 were seven per cent greater than a year ago, according to the Federal Reserve compilation; for the four-week period ended on that date, the gain over comparable sales last year was 14 per cent.

The movement of railway freight during the week ended Feb. 22 reflected the influence of a holiday. Loadings totaled 678,493 cars, 5.9 per cent fewer than in the preceding week, but 14 per cent more than in the corresponding period last year.

Electric power production in the same week rose contra-seasonally to a level 14.9 per cent above that a year ago; the similar gain for the week before was 13.5 per cent.

Bank debits to deposit accounts, except inter-bank accounts, in leading cities for the week ended Feb. 26 were 21 per cent greater than a year ago. The total for the 13-week period ended on that date is 10 per cent above that a year earlier.

Crude oil production for the week ended Feb. 22 averaged 3,629,650 barrels daily, or 8450 barrels below the average for the week before and exceeding by only 750 barrels the current requirement as computed by the Bureau of Mines.

Average daily output of bituminous coal during the same period was 1,800,000 tons, as compared with 1,733,000 tons in the preceding week and 1,538,000 tons a year ago.

Engineering construction contracts awarded during the week ended Feb. 27, which included a holiday, were five per cent below the figure for the week before, according to *Engineering News-Record*. The year's cumulative total to that date, $1,019,950,000, exceeds by 120 per cent the comparable 1940 contracts.

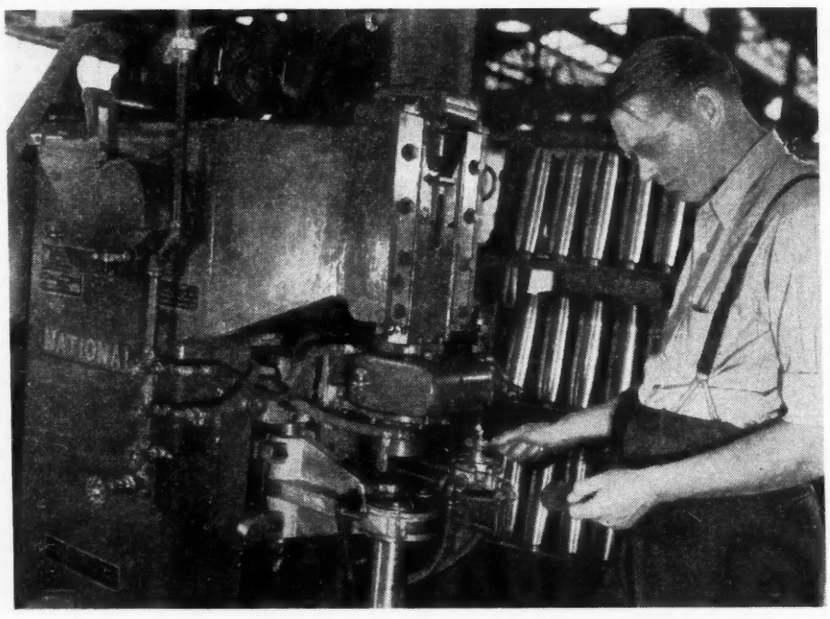
Cotton mill activity was unchanged in the week ended Feb. 22, failing to show the usual seasonal decline. The New York *Times* adjusted index rose to 144.9 per cent of the estimated normal, as against 142.9 for the preceding week and 118.1 a year ago.

Professor Fisher's index of wholesale commodity prices for the final week of February advanced one fractional point and stands at 86.0 per cent of the 1926 average.

Member bank reserve balances increased $154,000,000 during the week ended Feb. 26, and estimated excess reserves rose $100,000,000 to a total of $6,540,000,000. Business loans of the reporting members increased $7,000,000, to stand at $5,227,000,000, or $903,000,000 more than the comparable total last year.

Hayes Mfg. Co. Elects

Rensselaer W. Clark, former vice-president of United Aircraft, has been elected president and a director of Hayes Mfg. Corp., Grand Rapids, Mich. William B. Cudlip, Detroit attorney, and Ira A. Moore, president of Peoples National Bank, Grand Rapids, were elected directors.



Thousands of Shells from Chrysler

Chrysler has equipped a section of its Lynch Road plant in Detroit to turn out one million cartridge cases and 250,000 shells of 75-mm. a year. Operator is shown welding a thin steel disc on a shell base.

SAE National Aeronautic Meeting in Washington

Five technical sessions and banquet featured the National Aeronautic Meeting of the Society of Automotive Engineers March 13 and 14 in Washington, D. C. The banquet gathering, which closed the affair, was addressed by C. C. Carlton, director of the Automotive Committee for Air Defense, on the subject, "Coordination of Aircraft Manufacture in Automobile Plants." Technical sessions were scheduled as follows:

March 13: Aircraft Engine—R. N. DuBois, chairman; "Compounding Facts and Fallacies," F. L. Prescott, U. S. Army Air Corps; "Design of Airscoops for Aircraft Carburetors," M. J. Kittler, Holley Carburetor Co.; "Present Status of Combustion Research," E. F. Fiock, Bureau of Standards. Aircraft—R. C. Gazley, chairman; "Some Factors Influencing Aircraft-Engine-Propeller Vibrations," C. M. Kearns, Hamilton Standard Propellers; "Considerations of the Design of Modern Aircraft Propellers," T. B. Rhines, Hamilton Standard Propellers; "Vibration Characteristics of Three and Four-Blade Propellers for High Output Engines," R. M. Guerke, Curtiss Propeller. Aircraft and Aircraft Engine—J. T. Gray, chairman; "Development of the Ercoupe," F. E. Weick, Engineering and Research Corp.; "Some Present Day Problems in Light Airplane Engines," Ralph S. White, Civil Aeronautics Administration.

March 14: Aircraft Engine—C. F. Bachle, chairman; "Modern Aircraft Engines for National Defense," Henry C. Hill, Wright Aeronautical Corp.; "Cooling Characteristics of Submerged Light Aircraft Engines," H. A. Ellerbrock, National Advisory Committee for Aeronautics. Aircraft—John G. Lee, chairman; Icing Problems Attendant to the Operation of Transport Aircraft," R. L. McBrien, United Air Lines; "The Development of a New Lateral Control Arrangement," Paul Baker, Vought-Sikorsky.

Chain Belt Elects

J. C. Merwin, vice-president of Chain Belt Co. since 1924 and treasurer since 1939, has been elected president to succeed C. R. Messinger, who died Feb. 4. G. M. Dyke, assistant treasurer, was elected treasurer, and A. F. Kessler, also an assistant treasurer, was elected comptroller. Walter Kasten, president of the First Wisconsin National Bank, Milwaukee, was elected a director to replace Messinger.

40 YEARS AGO

A curious method of effectively demonstrating the superiority of pneumatic tires over iron tires in respect to comfortable riding was employed by a manufacturer of pneumatics at the Paris Exhibition. A sort of "flying Dutchman" consisting of two horizontal beams crossing each other at right angles, and turning about a shaft at their center, had been constructed. The beams were supported at their ends by wheels, two of which were iron tired and two rubber tired, and directly over each wheel was a seat.

From the *Horseless Age*, March, 1901.

PUBLICATIONS

A folder, containing samples and describing **Irvington Varnished Fiberglas,** has just been released by the Irvington Varnish & Insulator Co. In addition to general information, the folder gives dielectric strengths of the five different cloth thicknesses now regularly manufactured, when impregnated and coated with insulating varnishes.*

The Ramsey Accessories Mfg. Corp. has released a new 32-page manual, **Piston Ring Service Manual,** covering the practical phases of piston ring and piston expander installations.*

The American Foundry Equipment Co. has a new booklet describing and illustrating its three items of **dust collecting equipment,** "Dustube" Dust Collector, High Efficiency Cyclone Dust Collector and Wet Disposal Unit.*

The **Oliver Ace Universal Tool and Cutter Grinder** is the title of a new booklet by Oliver Instrument Company giving complete information and specifications of their new Ace Grinder.*

Oakite News Service (January-February issue) contains an interesting article entitled, **"How to Clean Copper and Zinc Alloys for Better Plate Adhesion."** Published by Oakite Products Inc.*

Thomson-Gibb Electric Welding Co. has a new folder describing and illustrating its line of **standard Spot, Press, Seam and Flash Welders.***

A revised edition of Bulletin T-7, by International Nickel Co., contains information on mechanical properties of **Inconel** at ordinary and at elevated temperatures.*

Hercules Powder Co. has issued a new and unusually complete technical booklet on **cellulose acetate,** giving data on properties, application and formulation of the material in the plastics, lacquer, film, automobile and other fields. It contains tables on physical properties, film characteristics, solvents, resins, and plasticizers for use with cellulose acetate. Charts of viscosity concentration and data on melting point, density, etc., are also included.*

The Neoprene Notebook No. 29, published by the Rubber Chemicals Division of E. I. DuPont DeNemours & Co., contains a statement regarding the use of **Neoprene** in manufacturing equipment for the National Defense Program. The issue also contains, among other features, an article on Creep and the Neoprene Notebook Index for the years 1938, 1939 and 1940.*

Lincoln Electric Co.'s Application sheet No. 73 discusses the use of welding in a **changeover of an eye and a clevis** in the redesign of a press.*

The March issue of Oxy-Acetylene Tips, The Linde Air Products' productions, contains an interesting and informative article on **"How to Weld 18-8 Stainless Steel."***

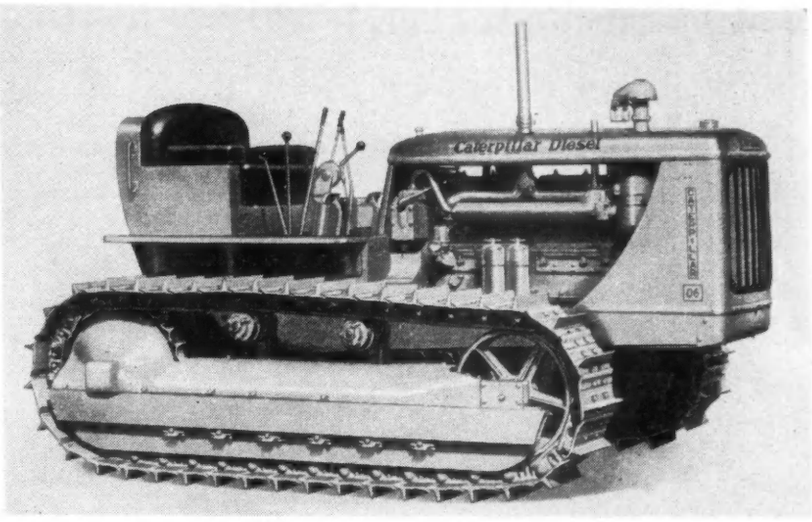
Caterpillar **Tractor** Co. has issued a new two-color catalog listing the more than 50 products which are manufactured by it. Illustrations and brief specifications are given of track-type tractors, road machinery, Diesel and natural gas engines, Diesel marine engines, etc.*

The Industrial Relations Department of Caterpillar Tractor Co. has released for the benefit of its employes, its second yearly booklet, **"The Year 1940,"** reviewing and coordinating the progress of all of its activities during the past year.*

The problem of **Spring Stress** is discussed in an exhaustive article in the February issue of The Mainspring, Wallace Barnes Co.'s house organ.*

A new **Photoelectric Relay** is described and illustrated in General Electric Co. Bulletin GEA 3533. **G-E Speed Variator** is the subject of Bulletin GEA 3517 and CR7006-D40 **Magnetic Starter** is described and illustrated in Bulletin GEA 841-K.*

* Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.



Caterpillar Track-Type Tractor

This D6 tractor is the latest addition to the Caterpillar Tractor Co. line. It has a 55 Hp. six-cylinder Diesel engine and weighs over 8 tons. A hydraulic unit is said to make steering as easy as an automobile.

Railway Express Agency Places Order for Trucks

Expenditures totaling over $4,000,000 for new automotive equipment have been authorized by the Railway Express Agency for a broad program of replacement and addition to the company's automotive facilities. Orders have been placed for 2667 trucks, tractors and trailers of specified design and capacities. Truck chassis and integral bodies are being built by separate manufacturers as the latter are of special design and all-steel construction.

Monthly Motor Vehicle Production

(U. S. and Canada)

	PASSENGER CARS		TRUCKS		TOTAL MOTOR VEHICLES	
	1941	1940	1941	1940	1941	1940
January	423,248	375,476	100,878	74,016	524,126	449,492
February	.....	350,535	.....	71,690	.....	422,225
March	.....	364,947	.....	75,285	.....	440,232
April	.....	375,828	.....	76,807	.....	452,433
May	.....	338,353	.....	74,139	.....	412,492
June	.....	294,779	.....	67,787	.....	362,566
July	.....	172,166	.....	74,005	.....	246,171
August	.....	48,333	.....	41,533	.....	89,866
September	.....	227,880	.....	56,703	.....	284,583
October	.....	428,270	.....	86,104	.....	514,374
November	.....	417,905	.....	93,068	.....	510,973
December	.....	408,184	.....	98,747	.....	506,931
Total	.....	3,802,454	.....	889,884	.....	4,692,338

Passenger Car and Truck Production

(U. S. and Canada)

	January 1941	December 1940	January 1940	Per Cent Change January 1941 over 1940
Passenger Cars—U. S. and Canada:				
Domestic Market—U. S.	401,799	386,729	349,755	+15.2
Foreign Market—U. S.	9,459	9,802	14,142	− 33.1
Canada	11,990	11,653	12,579	− 4.5
Total	423,248	408,184	375,476	+ 12.8
Trucks—U. S. and Canada:				
Domestic Market—U. S.	77,682	73,484	55,046	+ 41.0
Foreign Market—U. S.	11,991	13,552	14,336	− 16.3
Canada	11,205	11,711	4,634	+142.0
Total	100,878	98,747	74,016	+ 35.0
Total—Domestic Market—U. S.	479,481	460,213	403,801	+ 18.8
Total—Foreign Market—U. S.	21,450	23,354	28,478	− 24.8
Total—Canada	23,195	23,364	17,213	+ 34.8
Total—Cars and Trucks—U. S. and Canada	524,126	506,931	449,492	+ 16.7

Today's Problems of the Aviation Engineer

(*Continued from page* 325)

materials, but gas is soluble in Neoprene. The interior is, therefore, coated with a gasoline-resistant resin, which is very effective. This construction is effective against both 30 and 50 caliber bullets, as many as 27 50-caliber having been fired through a 20-in. square panel without leakage.

The landing strut for the great Douglas B-19 bomber is an important item in new plane development. This landing gear has a tire 36 in. x 96 in., and a 12-in. hydraulic piston moving 22 in. in two-tenths of a second. It carries 20 gals. of oil and 2060 cu. in. of air. The total travel of tire and shock is 58 in. in nine-tenths of a second. The forging is made of S.A.E. 4340, and weighs 15,000 lb. Total forging weight for the three struts was 53,000 lb. originally, finishing at about 4,000 lb. A special forging machine will be necessary for production, and the largest turret lathe in the world—150 in. swing—was built for the machining. A special laboratory was built for testing, and when the strut is dropped under load, a specially built recording machine, using three television plates, records minutely the electric impulses produced. The shock absorber was tested with an internal bursting pressure of 251,000 lb.

Ameripol for synthetic rubber tires can be produced for about 25 per cent more than natural rubber. It is made from petroleum, natural gas and soap. Plant facilities would be needed, and this would be a tremendous program—but we *can* be free from foreign rubber sources.

Heat resisting tubes for airplanes have been developed—because airplane brakes develop enormous heat for a short period. Blow-out protection has been applied to aircraft, making possible a safe landing if a tire should blow during take-off. Electrical conducting tires, rubber tractor treads, rayon in place of cord to give 10 per cent weight saving, perfectly balanced tires—because they go from stationary to 100 m.p.h. upon landing—improved de-icers—these have been developed and elaborate testing apparatus has been at work on the various projects.

The Douglas plane itself was started five years ago to test the practicability of this type of plane. It weighs 140,000 lb., has a range of 7500 miles with a bomb load of 36,000 lb. or 125 fully equipped troops. It is 112 ft. long, wing spread 212 ft., has four 2000-hp. engines, and will cruise at 210 m.p.h. It is 35 ft. from the ground to the pilot's seat. The plane has a telephone system of 24 stations, four 2-way radios, and carries a crew of ten.

A new bomber design, released by Glenn Martin, has the following characteristics: It weighs 250,000 lb. and will carry 80,000 lb. of bombs 3700 miles, or 40,000 lb. 7000 miles at 300 m.p.h.

Regardless of press comment to the contrary, our newest fighting designs are the finest in the world, and our motors are known to be the most dependable. War is the only test of war material, and we quickly learned that we needed increased armament and speed—we have both. A comparison of a Spitfire with an Airacobra shows the following:

SPITFIRE

367 MPH @ 18,400 feet; Ceiling. 30,500 feet
Climb 15,000 feet in 7 min.
8 guns—10,000 rounds/min.
New Spitfire—8 guns
4 cannon

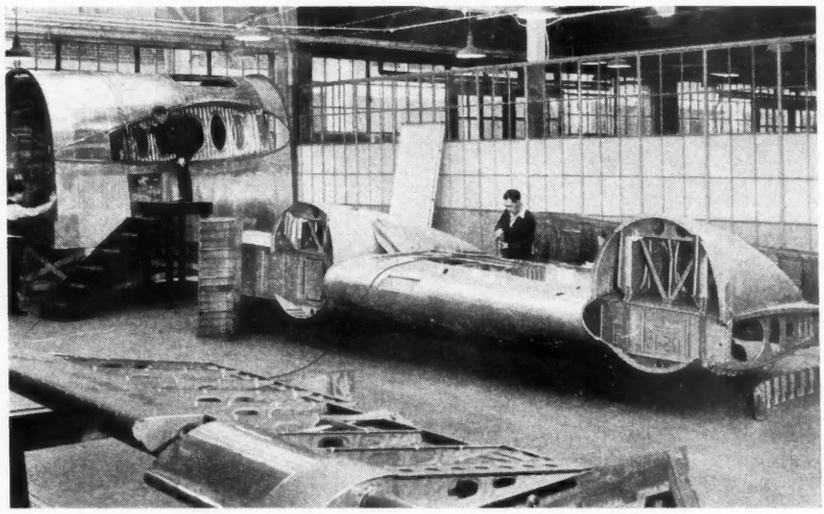
AIRACOBRA P 39

400 MPH—15,000 feet in 4 min. Ceiling 35,000 feet
Cruising range 1,000 mi. at 250 mph., 170 gal.
2—30 cal. each wing
1—20 MM cannon through nose
2—50 cal. through prop.

It is interesting that British tests have shown that the recoil from the guns firing in unison slows the plane down about 35 m.p.h. As guns increase in number and caliber, likewise armoring increases. The situation is similar to a gun and armor manufacturer who explained as follows: "I make armor, the specification being that it must be 5 per cent better than the best gun; I then make guns, the specification being that they must be 5 per cent better than the best armor. That keeps me pretty busy."

This race of armor versus guns may end up in purely bomber combat, although there is some thought today in America of sacrificing armor for performance. The trend in England is toward sacrificing performance for protection. More armor, more guns, means less performance—the plane designer cannot give both. The ammunition load is a real weight problem. Most fighters now carry fuel for only one hour and a half. Armor, more fire power and ammunition will reduce this time.

The power turret will soon be standard equipment on bombers, for protection. It gives a wide field of fire—360 deg. laterally and 85 deg. vertically—and does not fatigue the operator. The 37-mm. cannon fires a high explosive shell which destroys by impact or concussion—the concussion will shatter ½ in. armor. The shells are tracers and self-destroying, and at close range they can lay down a devastating barrage against fighter planes. They eliminate former "blind spots." The guns are operated by foot triggers, and the electric drive is supplemented by hand wheels for emergency use. We will constantly hear of new speed and other records, because we are in full swing from commercial to war-plane production—the amateur is catching up with the professional.



This view of the exhibit, in the Graham Paige plant of the Automotive Committee for Air Defense shows a section of the Consolidated B-24 fuselage at the left and a wing section at the right

One of my British correspondents has these comments, learned from the war:

Standardization in engine and plane production is vital. Accessories should be standardized, making field servicing easier. A smaller number of superior machines, with better pilot training, can deal with a much larger number of enemy planes inferior in both respects. Therefore, development work must go forward on engines, accessories and planes and quality must be maintained. Both engine and plane materials should be standardized, making substitutions available for materials not easily procured. Engine installations should be in the form of power eggs, disconnect-

ing only the controls to remove the complete powerplant. Engines should be started from the cockpit. Underground hangars allow planes to take the air quickly at full throttle without cold oil troubles.

Increased accuracy in bombing may change the aspect of future war. Our bomb sight is unquestionably the most accurate known—hits have been made in a circle of 50 ft. diameter, from 18,000 ft. The aerial torpedo, suicide dive bomber, and increasing bombing accuracy will greatly harass surface fleets. At present there is no defense for night bombing.

The only defense against bombers is the fighter plane with heavy offensive armament. Eight machine guns and one cannon, or eight machines guns and four cannon are recent examples. The American trend is toward fewer guns of larger caliber. Bomber speeds are becoming faster than present pursuit ships, and the rate of climb has increased tremendously. There is a decided trend toward auxiliary powerplants.

BOOKS . . . .

HIGHWAY SAFETY AND AUTOMOBILE STYLING, *by Arthur W. Stevens. Published by Christopher Publishing House, Boston, Mass.*

This book is based on the assumption that a large proportion of automobile accidents are due to the fact that the driver sits low behind a long hood and cannot see the road directly in front of the car. As a remedy the author suggests that the engine be placed at the rear of the car. He quotes extensively from Wm. B. Stout and others advocating this location of the power plant.

LABOR DISPUTE

(*Continued from page* 348)

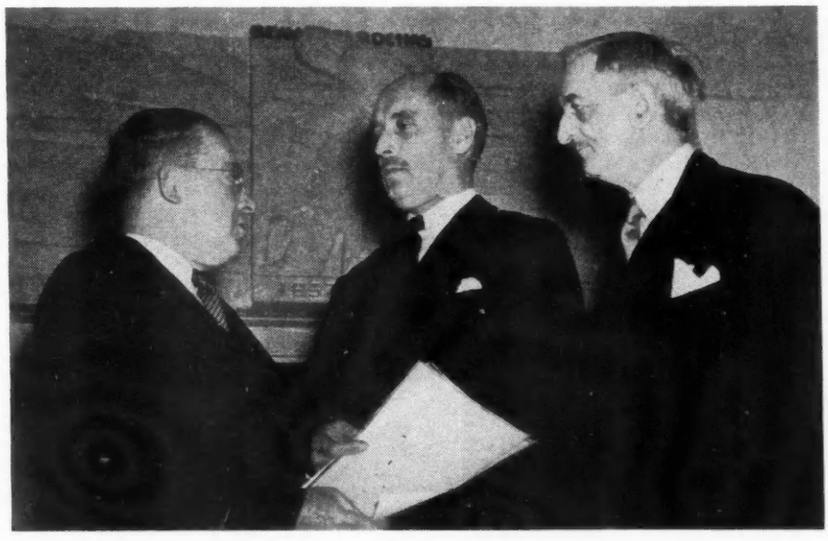
national Brotherhood of Carpenters. Four machinists putting in new machinery were called off the job Feb. 28 by the subcontractor when the carpenters threatened to halt construction work on the unfinished part of the building.

Ignoring the 30-day strike notice required of defense industries, 600 employees of the Federal Motor Truck Co. walked out March 7. The company has $5,175,000 in orders for U. S. Army trucks. Notice of intent to strike had been filed by Feb. 25.

A compromise proposal worked out by Federal conciliators with the UAW-CIO and submitted to the Allis-Chalmers Mfg. Co. in an effort to end a strike at its Milwaukee plant, where 7800 men are employed, was rejected by the company Feb. 26.

The International Harvester Co. strike spread to a fourth plant when 6000 employes at the Chicago McCormick works walked out Feb. 26.

Negotiations for amendment of the continuing contract between the UAW-CIO and General Motors Corp. began March 11 at the corporation's Detroit offices and will continue with three sessions daily. Bayard D. Kunkle, vice-president in charge of labor relations, will head the General Motors representatives, while Walter Reuther, director of the union's GM division, will be the principal UAW-CIO negotiator. The union, which holds exclusive bargaining rights in 71 GM plants, also announced it would seek additional elections in 13 GM plants, including five won by the UAW-AFL in the Labor Board election of last April.



Plaque for Beau de Rochas

In honor of Beau de Rochas, originator of the 4-stroke cycle for the internal combustion engines, a plaque, replica of one in Paris, was unveiled Feb. 26 at Franklin Institute, Philadelphia. It was presented by the French SAE with American SAE and French Officials cooperating. Among those at the exercises, left to right: H. L. Brownback, SAE; H. B. Allen, Franklin Institute director; M. P. Coppinger, French consul.

O. R. McDonald

O. R. McDonald, well-known in the automotive and industrial equipment fields, has been appointed sales promotion director of the Brunner Mfg. Co., Utica, N. Y., manufacturers of air compressors and refrigeration equipment. In 1937 he was a member of the merchandising committee of the NSPA, representing the equipment manufacturers, and in 1938 served as a director of the organization.

ARMY BOMBERS

(*Continued from page* 345)

of floor space, in which to manufacture airplane parts. Goodyear already has defense orders totaling $5,910,616 and is slated to build the wheels and landing gear for the Martin B-26 bomber in the ACAD program.

First of the 1000 heavy machines to be used in the Chrysler Tank Arsenal was installed early in March and the building is scheduled for completion the first week in April. Fifty per cent of the machinery ordered is on hand and three tanks are due to be completed by Aug. 15, the forerunners of an order for 1000 of the 25-ton vehicles. Regular production is due to start in September. Eleven subcontractors have been lined up for making transmissions and final drives. Continental Motors Corp. is working on an order for 400-hp. Wright Whirlwind engines to power the Chrysler-produced tanks.

Aeronautical Products, Inc., of Detroit, has received a government contract for $495,880 to double its plant facilities for the manufacture of precision aircraft parts for landing gears, engines and carburetors. Briggs Mfg. Co. has been awarded $288,100 for additional machinery and equipment to fabricate outer wing assemblies on a subcontract from Douglas Aircraft Corp.

MEN and MACHINES

(*Continued from page* 344)

In addition to the foregoing, a major advantage is the fact that the container simplifies handling at the receiving end since the load is kept in the box, transported to the points of usage where it serves as the bank of material, eliminating many of the customary handling and storing operations.

Another of the motor car manufacturers is studying the matter with the objective of standardizing upon a container which would be used by all of its suppliers when shipping parts to the factory. In this case the containers, as received, would be transported directly to the proper assembly stations and the parts drawn directly from the box.

It is of interest to note that one of the large boxes made by the General Box Co. has a capacity of 25 cu.ft. and holds a load of about 2300 pounds.

THE PROBLEM of reducing excessive costs of industrial elevator installations without loss of operating efficiency, safety, speed or other desirable advantages has commanded the active attention of industrial executives, engineers and architects during recent years. For this reason, many are watching the successful application of oil-hydraulic elevators to industrial use.

Particular interest has centered on the use of such elevators, manufactured by the Rotary Lift Company of Memphis, Tenn., in New York's recently completed Airlines Terminal. As all hydraulics push loads up from below instead of pulling them, an excessive load-carrying structure was not necessary, thereby reducing the cost. Fast, safe lifting is accomplished by simple push button control. To raise the load, operation is by oil pumped electrically into a plunger. Descent is by gravity. (*Shown on page* 344.)

Each elevator has a 30 by 6½-ft. platform and a capacity of 12,000 lb., operating over a travel of 37 ft. at a speed of 65 ft. per min.

A NEW attachment has been developed by the Delta Mfg. Co. of Milwaukee, for 14-in. drill presses that provides a wide range of speeds for both high speed and slow speed models. This attachment consists of a heavy casting, which mounts in the drill press column, together with a cone pulley and two belts. Belt slack is taken up turning the castings so proper tension is always assured. A range of 12 speeds is available through various combinations. (*illustrated on page* 344.)

The multi-speed unit is quickly removed and easily adjusted. A grease-sealed ball bearing pulley is used in the assembly for smooth even, vibrationless running. With this attachment it is possible to use a standard 1725 r.p.m. motor, where a special high speed or slow speed motor would ordinarily be required.

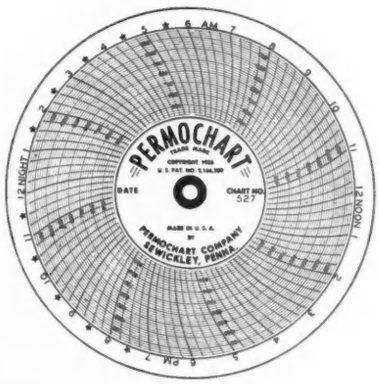
Another new Delta product is a drill grinding attachment, which is precision built and uses the face of the wheel for sharpening drills. A setting attachment with an accurate scale permits micrometer settings that insure evenly ground lips so that the drills run true. The amount of lip clearance on the drill is just right with enough of the heel cut away to provide enough clearance without weakening the cutting edge. An additional feature of this new drill grinding attachment is that anyone can adjust it so that each drill can be ground to fit the job with lip clearance and angles at any degree required. It can handle ⅛-in. to ⅝-in. drills.

OF PARTICULAR interest to laboratories for measuring the resistance of surface finishes to rubbing abrasion is the new Research Model Taber Abraser that has been announced by the Taber Instrument Co., North Tonawanda, N. Y. Combining many important improvements of previous models, it is intended for testing paints, lacquers, electroplated and plastic surfaces, and textile fabrics ranging from sheer fabrics to upholstery. An outstanding feature is an adjustable weight system that permits varying pressures of the abrading wheels against the specimen as required by the particular type of material under test. Complete and coordinated supplementary equipment is available for use with the instrument.

Research Model Taber Abraser

The primary elements of the abraser are the motor driven turntable on which the specimen is mounted, a counter to indicate the number of abrasion cycles, and two abrading wheels that alternately rub back and forth, and at the same time crisscross in their rolling path. These wheels are made in five types of closely controlled resilient material charged with special grades of fine abrasive grain.

Supplementing the wear resistance tests is the shear-hardness test performed by a special attachment that measures the toughness quality of a plastic surface or its ability to resist digs, scrapes and similar physical damage not classed as normal wear.



Plastic recording chart

AN IMPROVED design in recording instrument charts made for re-use has been developed by the Permochart Co., Sewickley, Pa. Made by vinylite plastic, Permocharts can be re-used constantly, as the previous day's ink record is easily removed from its surface with a damp cloth. It is said that they will not curl, are non-inflammable, and are oil, gasoline and grease resistant.

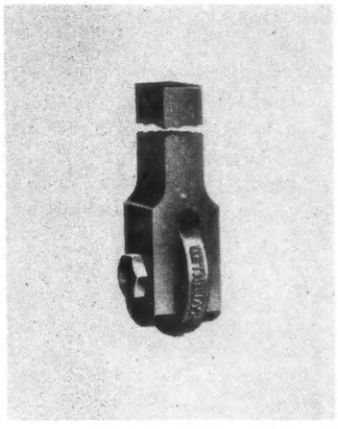
Because each chart is in use over a long period of time, chart centers are now reinforced to prevent deterioration, even from holding devices using sharp projections. The printing and laminating of Permocharts have been improved so that the charts are now clearer and cannot separate at the edges. Each chart is guaranteed by the manufacturer for daily use over a period of two years under normal working conditions. They are made for all types of recording instruments which use circular charts. Special charts can be made upon request.

For applications where it is neces-

sary to save chart records, the Permochart Company has established a microfilm photographic system for recording and filing. According to the manufacturer, this method reduces filing space by 98 per cent.

TO ENABLE machine shops and factories using lathes to quickly mark products or parts without waiting for the delivery of marking equipment, the Acromark Corp., Elizabeth, N. J., makes this new combination steel roller die and holder to fit in the tool post of standard lathes.

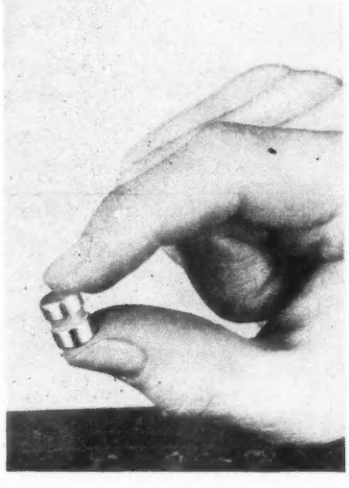
The steel roller die can be engraved



Acromark marking die

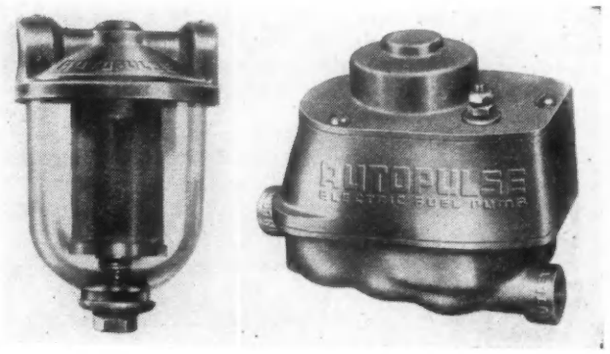
with any numbering, lettering or design. If interchangeable lettering or numbering is to be done, the roll can be made to receive segment style interchangeable steel type. For continuous marking where the part must completely rotate for applying graduations to a ring, for example, a larger fixture is furnished so the part and the die can be synchronized by meshing gears.

DURAKOOL, INC., of Elkhart, Ind., announces a new low-priced all-metal mercury switch called the Tipit.



Tiny Tipit mercury switch

The Tiny Tipit, which is illustrated, has a capacity of one-half ampere at 24 volts to four amperes at six volts. It is ideal for use in explosive atmospheres, on electrical machinery, with automobile rear trunk lights, under-the-hood illumination, glove compartment lighting, and other places where infrequent operation of a low-watt circuit is desired. This midget switch mounts in a small holder with screw stakes for terminal connections. It operates on a tilt of 20 degrees or more.



(Left) Autopulse fuel filter. (Right) Autopulse Model 400

AUTOPULSE CORP., Detroit, has begun shipment of a new and added series of larger-capacity electric pumps, the Model 400. Appearance of this pump is entirely different from the Model 300, which has been in manufacture since 1928 and continues unchanged, but the action and performance of the new pumps along the same general lines except for the greatly increased output.

Model 400 is built in two types—for standard and for marine use. The standard model has a rugged cast iron body and a magnetic shell of drawn steel. In the marine model, the pump body is brass and the magnetic shell of stainless steel, thus insuring a resistant armor to salt air and salt water.

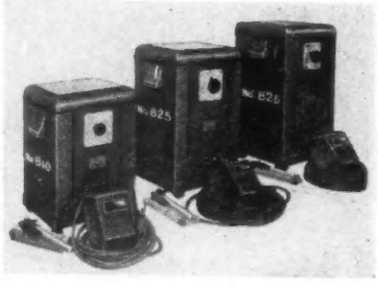
The standard pump weighs 3¼ lbs., a few ounces more than the Model 300, and it delivers 22 to 28 gal. per hr. through an average-sized passenger car carburetor inlet. This is claimed to be the largest output of any single electric pump ever built. As with all Autopulses, the pump's operation is controlled by carburetor back pressure, the action being either slow or speeded up to care for the engine's varying fuel requirements.

It is built with an integral screen-filter with the disc-type optional, and there is a permanent air dome to insure an extra smooth flow of fuel. Since capacity is so much in excess of ordinary requirements, no duplexes, triplexes, or other multiples will be built as it is believed that any engines which could use more than one pump will have multi-carburetor equipment, so that a convenient application would be one pump to each carburetor.

The new model has some 30 per cent fewer parts than the older type and is simpler in assembly and service. However, for the 1941 season, the service policy will be factory replacement of complete units rather than repair by parts.

An interesting development is a molded diaphragm of synthetic rubber, which acts as the pumping member. Tests show extremely effective action and long life. This diaphragm replaces the metal bellows, which has been a feature of Autopulse construction since the introduction of the pump in 1928.

Along with the new pump, the Autopulse Corp. has introduced a line of fuel strainers. These are conventional in design, except that bowls may be had of drawn-steel or drawn-brass instead of glass, thus avoiding danger from tire-thrown rocks. There are four strainers in the line: one with die-cast body and glass bowl, a similar one with drawn-steel bowl, one with forged-brass body and glass bowl, and a similar construction with drawn-steel bowl.



Eisler A.C. Transformer Type Arc Welders

EISLER ENGINEERING CO. of Newark, N. J., has placed on the market a new model arc welder of the alternating current transformer type, which is available from 100 to 400 ampere capacity. They are made standard to operate on 220 volts, 60 cycles, alternating current of single phase, or any single phase of a polyphase circuit. They are also supplied for 440 or 550 volts at no extra cost.

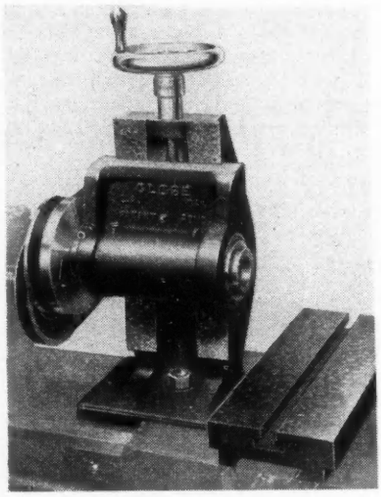
Some of its outstanding features are ease of striking and holding an arc, simplicity of control, value of current and size of welding rod indicated for each dial setting, non-inflammable and heatproof insulation, no rotating parts

in the machine, and mounting on rubber covered swivel casters. These Eisler arc welders also are available on two smooth-rolling wheels specially designed for rough and outdoor surfaces.

Standard equipment with each welder consists of a light weight type welder's helmet, electrode holder, 25-ft. heavy duty flexible cables, assorted electrodes, and a slag removing wire brush and chipping tool.

AS ILLUSTRATED here, the new milling attachment of the Globe Products Mfg. Co., of Los Angeles, Cal., employs the lathe spindle for its drive and makes use of the carriage movements to operate its table. The spindle is carried on a vertical slide so the spindle can be positioned or moved up and down. Among other accessories is a ball bearing arbor support for attachment to the lathe tailstock spindle so a cutter arbor can be applied in manner similar to that on a standard plain milling machine with an overarm.

The spindle is mounted on ball bearings and its drive system permits vertical positioning through a six-in. distance above the table. Overall dimensions of the table are 4¼ by 12-in. It clamps to the cross slide on the lathe carriage as indicated in the illustration.



Globe milling attachment

Originally developed in 1939 and distributed in the Southern California district only, this tool is now available nationally for Atlas and Craftsman lathes, except six-in. sizes; nine and 11-in. South Bend lathes, and 10 and 11-in. Sheldon lathes. The milling head may also be attached to other makes of lathes, and larger sizes of lathes, by the use of a special adapter base plate, a slight change in the cross-feed screw nut and necessary machining of the base of the column and the table.

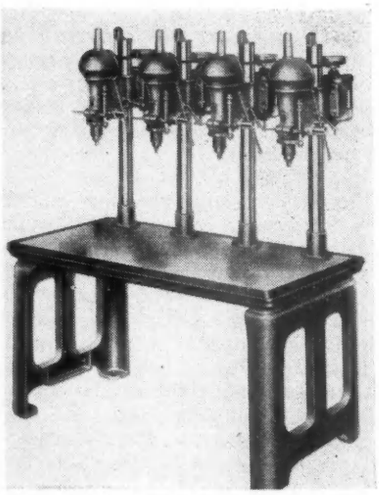
M. E. CUNNINGHAM CO. of Pittsburgh, Pa., has developed a roll brander of the floating type that is claimed to reduce considerably the time of marking mill rolls. Both the roll and roll holder are one-piece construction to eliminate the possibility of thread or screw failures. The floating type feature is incorporated in the device to allow each piece of type to level itself in the roll with no chance of it being wedged in an off position. This design feature is said to result in a

Cunningham roll brander

much clearer branding with every character the same depth and to prevent type breakage because the pressure always is on the center line. The steel type is inserted and held in place by an entirely new method which eliminates the need for spacers and thereby is said to reduce setting up time at least 50 per cent.

RELIANCE ELECTRIC & ENGINEERING CO., of Cleveland, now makes an all-electric adjustable speed drive for alternating current circuits to use with small units of one hp. and up. Its basic design follows the same principle of speed control as incorporated in other Reliance V*S drive units for rolling mills, elevators, paper making machines, automatic lathes, and automobile engine balancing machines. The drive equipment includes a speed control unit that can be used on a two-phase or three-phase alternating current circuit, a Reliance heavy duty type T motor designed particularly for adjustable speed service, a speed adjuster and start-stop push buttons. Operating speeds are provided over a 16 to 1 range with provision for greater ranges if desirable.

NEW 1941 multiple spindle drill presses are supplied in two or four spindles by the Duro Metal Products Co., Chicago. This arrangement enables the operator to perform drilling and tapping operations speedily and economically. Each spindle runs on four sets of permanently lubricated ball bearings. Splined shafts permit long travel of chuck and the Jacobs chucks take up to ⅝ drill. Their hinged motor mountings simplify changing of belt speeds. Each unit is supported by

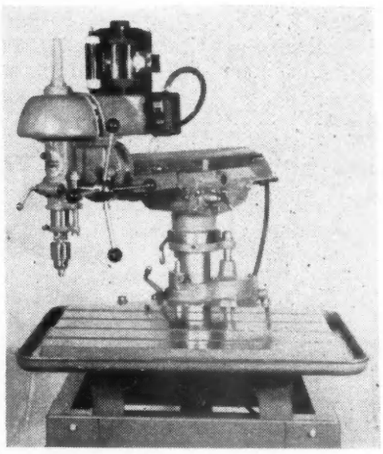


Duro multiple spindle drill press

a rigid 2¾ in. steel column to prevent vibration. The spindle table is 20½ by 50 in. and has a 1¾ by 2 in. oil trough. The distance between spindles is 12 in.

WALKER-TURNER CO., INC., of Plainfield, N. J., announces a new radial drill for performing light duty operations. It is designed to perform such operations as drilling, tapping, routing and light profiling with speed and accuracy.

The drill head is mounted on a heavy cast iron ram, which rides back and forth in a supporting "cradle" on eight ball bearings. The drill head, ram and cradle swing easily right and left on a machined collar mounted on the top of the raising and lowering column. They are raised or lowered by



Walker-Turner radial drill

a crank operated screw mechanism mounted on the side of the supporting column. Clamp locks are provided for locking the drill in the desired position. The drill head can be tilted up to 45 degrees, either right or left.

This machine permits drilling to the center of a 62 in. circle. It has a ram

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King-Seeley, in recognition of their responsibility to the car manufacturer, has been constantly at work on a research program to make Electric Telegages foolproof and failure-proof.

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travel of 18 in. and the maximum distance of the chuck to the table is 13½ in. Vertical movement of the drill head is 8½ in. and spindle travel is 3¾ in.

AN INTERESTING line of production grinding gages and electric sizing gages is being marketed by the Foster Engineering Co., Ferndale, Mich. In general, the Foster production grinding gages are said to be of rugged construction, built to high standards of quality, designed for use on external grinding machines. Caliper frames are made of steel with sufficient rigidity to prevent bending or misalignment. Gaging points are made of cemented-tungsten carbide.

The gage is said to automatically check out-of-roundness, amount of error, round grinding, chatter, and finish-dimensions to a tolerance of 0.0001 in. It is provided with simple universal adjustments to accommodate a wide variety of sizes.

In its application to spline shaft gaging, the gage comprises a quickly replaceable caliper frame with full cemented-tungsten-carbide faced shoes to prevent wear.

Auto Manufacturers Moderate Steel Buying

Consumers Advised to Place Orders According to Their Needs; Government Sets Maximum Price on Aluminum Scrap

While the report made to the President by Gano Dunn, senior consultant of the Office of Production Management, on the country's steel capacity and the probable extent of 1941 requirements was nothing more than corroboration of what steel producers had been saying right along—that the steel industry's capacity is adequate for both military and civilian needs—it has been decidedly helpful in clearing the atmosphere. Aside from stilling the clamor of a relatively small group of fault-finders, who advocate plant additions without limit, regardless of whether or not they will be useless after the emergency has passed, the Dunn statement has paved the way for a more rational approach of the priority problem.

Notice now has been definitely served on consumers that there is no question of a steel famine, but one of buying according to their needs. Orders of automobile manufacturers in the last few weeks show that they are keenly aware of the need of moderation on the part of steel buyers at this time. The overwhelming amount of business placed in the Detroit district was for second quarter delivery, a minor volume of commitments being placed for delivery after July 1. This condition is in contrast with that prevailing elsewhere.

In some markets second quarter books were reported long ago to have been filled and incoming business largely for third quarter deliveries, with some buyers asking for a place on fourth quarter backlogs. That the ordering of steel a few weeks ahead of when it would be needed is a thing of the past, but reports that automobile manufacturers are "stocking" in the sense that they are warehousing huge tonnages of steel meet with shoulder-shrugging in the trade. The rate of steel mill output for the week ended March 8 will record another new high, the American Iron & Steel Institute's estimate being 97.5 per cent of ingot capacity, compared with 96.3 per cent in the preceding week. This reflects top takings by the automotive and other consuming industries aside from speed-ups in the production of defense materials.

Establishment by the price stabilization division of the National Defense Advisory Commission of an 11-cent per pound ceiling on the price at which airplane manufacturers are to sell mixed aluminum scrap, followed disclosure of chaotic conditions in the market for secondary aluminum. It was learned that 28 cents a pound was paid for a round tonnage of No. 12 alloy (grade 2), quoted at 21 cents recently, but usually selling at around 14 cents. Refiners of secondary aluminum have been blaming scrap sellers and dealers for the abnormal price situation. The Government resorted to the fixing of a temporary maximum price, at which aluminum scrap is to be sold by aircraft plants, as the most effective means of restoring normalcy. For nickel scrap as high as 38 cents a pound has been paid of late, although the new metal sells at 35 cents. Similar dislocation of values is noted in the scrap zinc market.

Although traders on the London Metal Exchange stage an occasional flurry in the tin market, the price of Straits tin here has tapered off further to 51¼ cents on March 3. This is still $22 a ton higher than before the recent flurry got under way, but $65 a ton below the recent peak.—W. C. H.

Review of Dunn Report

Estimates that the automobile industry will require 8,400,000 tons of steel during the fiscal year 1941 and 9,500,000 tons in 1942 were made in the Dunn report, which also contained estimates supplied by Dr. Melvin G. de Chazeau, economist attached to the OPM's production division, who placed total civilian requirements at 43,900,000 tons for the fiscal year 1941 and 50,500,000 tons for 1942.

Also included in the Dunn report were estimates made by Harold H. Wein, of the civilian requirements division of the National Defense Advisory Commission, that the automobile industry would need 8,600,000 tons of steel in the fiscal year 1941 and 10,100,000 tons in 1942; and that the total civilian steel requirements would amount to 62,600,000 and 74,600,000 tons respectively. The Wein estimates were included, it was explained, because they were the only estimates higher than those supplied by Dr. de Chazeau, although Mr. Dunn reported receiving several estimates that were lower.

National Income of $80,000,000,000

Mr. Dunn, however, accepted the de Chazeau estimates, which were based on the assumption of a national income of $80,000,000,000 in 1941, $90,000,000,000 in 1942, and a greatly increased demand for steel for civilian uses as a result of the rise in national income.

Not only did the Dunn report find steel capacity adequate, but by an even distribution of orders throughout the industry, and by a shortening of the periods now required for repairs, there will be an excess of ingot-producing capacity over total requirements of 10,100,000 tons during the present year, and 2,100,000 tons in 1942.

President Roosevelt called the report encouraging and noted that it should set at rest a lot of loose talk concerning the subject of steel capacity. The steel study will be kept up-to-date by Mr. Dunn, who has been requested by the White House to report back every three months.

OPM Priority on Nickel, Magnesium and Neoprene

Joining the category in which machine tools and aluminum were listed previously, magnesium and nickel have been placed on the OPM mandatory priority list, which means that British and American defense orders for these strategic war materials will take precedence over civilian orders. Neoprene, a synthetic rubber, also was included on the priority list.

George R. Meyercord

George R. Meyercord, age 65, Chicago, chairman and former president of Haskelite Mfg. Co., and member of the advisory board of the Illinois Manufacturers Association, died Feb. 22 in a New York City hospital. He organized the Meyercord Co., makers of decalcomania transfers in 1894, and the Vitrolite Co., and was president of the American Manufacturers Foreign Credit Underwriters and American Tariff League.

Air Superiority Begins on the Ground

(*Continued from page* 328)

is climbing, banking, rolling and gunning for life.

Of course, the automobile production man knew about airplane gears before he started to study them, but it took a meeting of minds with a few other engineers before the facts about those gears became matters of life and death to him. The moment he sensed this, his entire attitude changed and he went slowly back through his pile of blue prints, studying them with new eyes.

Now it is certainly most uncomfortable and possibly quite inappropriate for any machine tool man to be even mildly critical of the methods or opinions of any expert on automobile production. In happier times the automobile industry is one of the machine tool builder's star customers, and the machine tool industry is naturally anxious to help the automobile engineers solve the huge new problems which they face today. On the other hand, the automobile industry needs, and will doubtless welcome help and information from many sources, including men in the machine tool field.

One of the most efficient ways to provide this information might possibly be patterned on the Canadian Shell Committee that functioned so effectively from 1914 through 1918. Primarily a farming country with only a few machine shops, Canada succeeded during those years in lifting production to amazing levels because Canadians were willing to ask questions and listen to the answers from each other and from British ordnance experts who came over to direct them.

Weekly regional discussions were held with one key man present from every factory in the area engaged on munition work. Distances to be traveled were short. Conferences were informal, questions pointed, answers generously volunteered by any present who had licked a similar problem. In many cases problems not solved in one region had been ironed out in another, and government men making the rounds from region to region and conference to conference carried lots of the right answers in their brief cases.

To one who went through the first World War in charge of a Canadian shop, this kind of conference appears as a logical, simple, effective method of smashing defense bottlenecks, reducing spoilage and improving standards all along the line.

The problems of 1941 are far more complicated than those of 1914. They can be solved in part by isolated geniuses slaving over piles of blue prints, but they cannot be solved in full unless we have a meeting of minds. No solution short of a full solution offers us anything but defeat. It is up to us to build the most of the best battle planes—OR ELSE!

Training for National Defense

(*Continued from page* 322)

approved by labor and the personnel office of the applicant's employer. Supplementary courses are offered four hours a day, one day a week, and are designed so as not to interfere with the employe's regular work. The length of the course depends upon the employe's individual aptitude. All enrollees must be at least 18 years of age and U. S. citizens.

Detroit, center of Michigan's defense activity, has more than 300 classes meeting in 50 class centers, including schools, NYA quarters, community centers and in factories. Total enrollment for the first half of February was 6,238 trainees. In the pre-employment and refresher group, there are 92 machine tool operating classes with more than 2,000 men enrolled, 50 welding classes enrolling 1,100, 17 classes for metal fitting and 10 for driver-mechanics.

To meet the demands for aircraft employes, especially at the Briggs Mfg. Co., which will employ 5,000 men in airframe fabrication when it reaches full production, two Detroit high schools, Commerce and Carstens, are running 24 hours a day, seven days a week, with a total enrollment of 720 trainees in 12-week courses. Classes run around the clock in order to utilize the equipment to the fullest extent to teach the men the theory and practice of airplane wing construction. Four hours daily are devoted to shop work and two to classwork. There is one instructor for each 30 men. Seven hundred men from such classes already have been employed by Briggs, which initiated the project last September and loaned its own tools and equipment as well as foremen to conduct some of the classes.

Just as lights burn all night in Detroit factories, so are the classrooms of these schools never vacant in order that the utmost use can be made of the available equipment. Four six-hour shifts keep the rooms continually occupied so that janitor work has to go on while the classes are in session. Machine tools cannot be readily replaced in the present defense emergency, so those available for instruction purposes have to be carefully serviced during the brief periods when they are not in operation by trainees.

Among the supplementary classes are three for airplane mechanics, four for airplane engine mechanics and four for aircraft welders. Most of these meet nights or Saturdays and Sundays to make use of the necessary equipment and in order not to conflict with employment. There is already a waiting list for defense training classes, as there are not enough instructors nor equipment to take care of the applicants.

Applicants for pre-employment training are interviewed by the Michigan State Employment Service and may be given vocational aptitude tests to determine their fitness or experience in certain lines of work. WPA applicants are referred through the WPA Employment Division and draw their WPA pay while enrolled. Assignment to classes is made by the vocational education office.

Other defense classes in addition to those detailed include drafting, sheet metal work, Diesel engines, electricians' refresher, foundrymaking, shop mathematics, cable splicing, welder control, aircraft layout, blueprint reading and machine tool inspection.

Michigan has been allotted $1,464,700 by the federal government for national defense vocational training as of March 1. A total of 7,276 workers were enrolled in supplementary courses at that date. Such courses have reduced unemployment among men over 50 by 37 per cent in less than a year, according to the Michigan Unemployment Compensation Commission.

The NYA cooperates with the vocational education program both with the conduct of courses at its own work experience centers and with enrollment of youths in defense classes. The emphasis in the NYA program has been changed from other projects to vocational training. In line with this change, classes have been established for machine shop, sheet metal, forge and similar work.

The NYA also has eight work experience centers in Michigan, of which the largest is located on the outskirts of Detroit, accommodating 900 youths between the ages of 16 and 24. Youths are given instruction in occupations for which they are fitted, including automobile repairing, drafting, woodworking and radio repair. The Detroit enrollment is divided into two shifts, each working alternately 10 days at a time. The youths live at the centers but leave if they obtain jobs in private industry.

Nationally, the NYA has given some mechanical training to approximately 480,000 youths over the past five years. As of Feb. 1 there were 165,182 students employed in local workshops and production projects, while another 36,410 were being trained at work experience centers. No attempt is made to turn out skilled workers but the program does help to fit youths for future industrial jobs. The NYA has been handicapped by a limited budget which

makes it impossible to provide adequate equipment or skilled instructors for intensive defense job training.

Similar to the NYA program is that for rural out-of-school youth for which vocational training classes have been set up in rural high schools to give them instruction that will help prepare them for industrial employment.

The WPA, through the vocational education classes, gave training to 26,000 workers from July through December, 1940. Of this number, 12,000 have been placed in private jobs. Another 26,000 WPA enrollees are now receiving training for defense jobs in more than 500 cities and towns. Workers with previous experience in industry take "refresher" courses of six to 10 weeks to regain their old skills, while workers with no previous training, or with experience in an occupation for which there is no immediate demand, enroll in pre-employment courses. Most popular courses have been machine operation, automobile repair, welding and sheet metal work. A few of the WPA trainees have shown such proficiency that they have obtained jobs as instructors in the defense training work.

All WPA workers are classified under the "Dictionary of Occupational Titles" prepared by the Occupational Analysis Section of the Social Security Board. This dictionary has proved useful in transferring workers from an occupation in which there is no shortage to a related occupation in defense work. Trade tests have been worked out for more than 150 occupations in defense industry. Oral trade questions may open up other fields of skill possessed by the worker in addition to that in which he claims proficiency. Employment tests for aptitude are valuable in finding rapid learners and also in determining an applicant's skill which may be similar to that in a related occupation in which there is a shortage. For instance, there are 128 types of welders listed in the dictionary, in which the technique for transferring skill from one type to another would not be difficult to master.

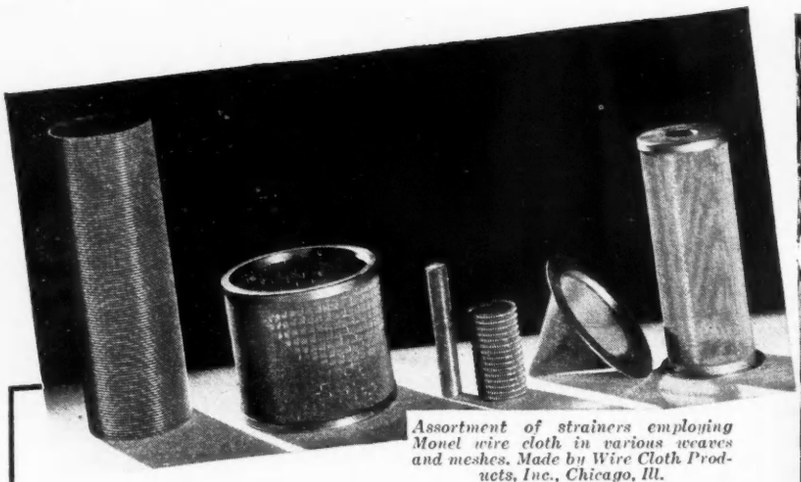
The CCC, which has engaged primarily in conservation work, trained 60,000 boys in the use of automotive equipment during 1940 and also gave instruction to 9,000 other boys on the repair, care and maintenance of automobiles. In order to supply the California aircraft industry with much needed workers, the CCC also set up a training course for aviation mechanics in September, 1939, at Camp Vista, near Escondido, Calif. During the first year several hundred CCC enrollees were given a 10-week course of study outlined by the aircraft companies, including 200 hours of shop work, and most of these boys obtained jobs in aircraft plants.

Another phase of defense instruction is the engineering training program in which special classes are held at colleges and universities for highly skilled technicians such as aeronautical engineering, tool engineering, production supervision, engineering drawing, aircraft mechanics, metallurgy and material testing. Enrollment is free for students who possess the requisite qualifications. Six Michigan institutions are cooperating in this program, including Wayne University, which has 1,575 enrollees in defense courses; University of Michigan, Michigan State College, University of Detroit, Detroit Institute of Technology and Western State Teachers College. More than 30,000 students are enrolled in these engineering courses throughout the country.

When this vast industrial army now in training finally assumes its places on the production line, the sinews of war will be provided in ever increasing quantities.

* * *

(This is the first of two articles on the training of men for the national defense program. The second, detailing the experience of automotive and aircraft companies in training workers for defense jobs, will appear in the April 1 issue of AUTOMOTIVE INDUSTRIES.)



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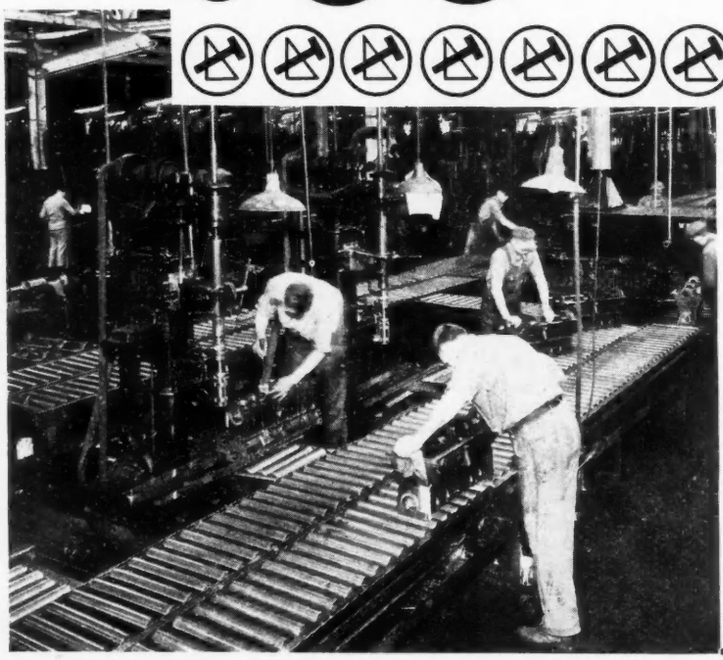

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